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Length of exercise history and depressive symptoms in community dwelling older adults

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LENGTH OF EXERCISE HISTORY

AND DEPRESSIVE SYMPTOMS

IN COMMUNITY DWELLING OLDER ADULTS

By

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Kelly McGrorey Broderick
July 6, 2010

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ABSTRACT

Depression is a serious illness that causes suffering in all aspects of one's life. Exercise has previously shown to decrease depressive symptoms in adults. This study investigated the length of exercise history and depressive symptoms in community-dwelling older adults. Subjects were grouped, according to length of exercise history, into five groups: non-exercisers; started exercise within the past year; exercise history between one and five years; exercise history between five and ten years; exercise history longer than ten years. Subjects completed the Center for Epidemiological Studies Depression Scale (CES-D), the Physical Activity Scale for the Elderly (PASE), the UCLA Loneliness Scale, and the Positive and Negative Affect Schedule (PANAS). The results indicated that there was a significant difference in CES-D across the groups ($p < 0.05$) and subjects with the longest exercise history (greater than 5 years) had the lowest depressive symptoms. There was no significant difference between the groups for the UCLA Loneliness Scale and the PANAS. These results support previous research that subjects with a long-term exercise history have lower depressive symptoms scores than those with shorter or no exercise history.

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The Problem and Its Scope

Introduction

Depression is diagnosed according to the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994), as having five or more of the following symptoms during the previous two week period with at least one being depressed mood, or loss of interest or pleasure from activities that were previously pleasurable. These symptoms include depressed mood, loss of interest or pleasure in previously pleasurable activities, significant weight gain or loss, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue, feelings of worthlessness or inappropriate guilt, impaired concentration, and recurrent thoughts of death.

Depressive symptoms present in older adults have been shown to be linked with a decline in physical functioning (Penninx, Guralnik, Ferrucci, Simonsick, Deeg & Wallace, 1998). The National Health and Nutrition Examination Survey, 2005-2006, reported that 5.4% of Americans 12 years of age and older experience depression during any 2 week period (Pratt & Brody, 2008). Depression is projected to rise from 216.2 million people in 2005 to 307.9 million in 2050. In older adult women it is predicted that prevalence will rise 107.7% to 5.4 million and 125% to 2.7 million in older adult men (Heo, Murphy, Fontaine, Bruce & Alexopoulos, 2008). Exercise has been shown to reduce the depressive symptoms in both depressed and non-depressed individuals participating in exercise interventions (Dunn, Trivedi, Kampert, Clark & Chambliss, 2005; Goodwin, 2003; Matsouka, Kabitsis, Harahousou & Trigonis, 2005). Silver Sneakers, an older adult exercise program studied by Nguyen, Koepsell, Unutzer, Larson and LoGerfo (2008) reported that depressed older adults are as likely to join an exercise program as non-depressed. The UPLIFT study by Sims, Hill,

Davidson, Gunn and Huang (2006) revealed that, among depressed older adults, the adherence rate to a physical fitness program is similar to that of anti-depressant medication.

The exact dose of exercise required for physical activity to influence depressive symptoms is unclear, however, many studies have shown that exercise reduces the risk of depression (Dunn et al., 2005; Kritz-Silverstein, Barrett-Connor & Corbeau, 2001; Teychenne, Ball & Salmon, 2008). There are other exercise benefits for older adults including increased flexibility, strength, coordination, and performance (Singh, Chin A Paw, Bosscher & Van Mechelen, 2006). The current study will examine the effect of length of exercise history over time on depressive symptoms to determine if the length of time a person has exercised proportionally decreases depressive symptoms as one ages.

Purpose of the Study

Depression affects millions of adults worldwide resulting in increased healthcare costs and decreased quality of life (Ng, Niti, Tan, Cao, Ong & Eng, 2007). The purpose of this study was to determine if a long term history of exercise provided a protective effect against depression in older adults. Specifically, are depressive symptoms lower in older adults who are long term exercisers? Additionally are there also any differences in the PANAS, UCLA Loneliness Scale or PASE?

Hypotheses

It is hypothesized that depressive symptoms will decrease as the length of older adults' participation in regular physical activity increases. It is also hypothesized that older adults who have been involved in an exercise program consistently, for over 10 years, will score lower on the Center for Epidemiological Studies Depression Scale (CES-D) than those with less exercise history. The secondary hypothesis is that older adults who do not exercise

will have no difference in positive or negative affect scores on the PANAS and no difference in scores on the UCLA Loneliness Scale compared to those with longer exercise history. Older adults who currently do not participate in any physical activity will have the highest levels of depression.

Significance of the Study

The results of this study will provide evidence for the principle of exercise for management of depressive symptoms in older adults. Many studies have previously determined that exercise decreases depressive symptoms; however few studies have examined the role of long term exercise. The results of this study can be used to enhance participation in exercise programs for older adults with depressive symptoms, as well as other age groups, to reduce risk of depression later in life.

Limitations of the Study

1. The results will only be valid among community-dwelling older adults.
2. Subjects' physical activity levels are self-reported and while this method is valid it may have some inaccuracies.
3. Number of days per week subjects exercised was used as an alternative to monitoring intensity. As subjects' exercise intensity was not monitored the levels of intensity among subjects may vary; this may affect the corresponding changes in depressive symptoms.
4. The results of this study will be valid only among older adults without any serious illness or disability preventing physical activity.
5. Participants of this study were not excluded from participation if they were currently taking medication to treat depression or had in the past.

6. The tester is only able to assess the characteristics of the depressive symptoms and cannot diagnose or determine depression in subjects.

7. Depressive symptoms of an individual are subject to change with life events, illness, or injury. While the depression scale is valid for use in this type of study comparing depression to another variable, events of the past week may affect the depressive symptoms of the subject.

8. Depressive symptoms can be affected by personality type and coping strategies of individuals.

9. Due to the cross sectional design of this study, cause and effect between exercise and depressive symptoms cannot be determined, only relationships between exercise length and depressive symptoms.

Definition of Terms

Center for Epidemiological Studies Depression Scale (CES-D) - The self-reported scale was designed to measure the depressive behaviors and feelings present over the past 7 days giving an assessment of depressive symptoms in the general population (Radloff, 1977). CES-D is not a diagnostic tool but gives a level of symptoms and was proved valid among many groups including older adults (Radloff, 1977).

Depression- Depression is diagnosed as having five of nine symptoms present over a two week period with one of the symptoms being either depressed mood or diminished pleasure in activities. These symptoms must impair social, occupational or other functioning or cause distress that must not be associated with substance abuse or medication, and are not the result of bereavement (American Psychiatric Association, 1994)

Depressive Symptoms- Present in persons who are not diagnosed as having major depressive disorder because they do not fully meet the criteria, but have symptoms of depression (Chapman & Perry, 2008).

Moderate Intensity Physical Activity- Includes activities that raise heart rate and cause sweating, but allows for the individual to carry on a conversation.

Positive and Negative Affect Schedule (PANAS)- The PANAS is comprised of 2 mood scales, one measuring positive affect and one measuring negative affect (Watson, Clark & Tellegen, 1988).

Physical Activity Guidelines for Older Adults- The guidelines recommended by the American College of Sports Medicine and American Heart Association are 30 minutes of moderate intensity cardiovascular exercise for 30 minutes a day, five days per week or vigorous intensity cardiovascular exercise for 20 minutes 3 days per week, and 8-12 repetitions of 8-10 resistance training exercises two days per week. For the purpose of this study subjects were considered to have met the requirements if they took part in physical activity 3 days per week because monitoring of intensity was not part of the study protocol.

Physical Activity Scale for the Elderly (PASE) - PASE evaluates physical activity in individuals over 65 years of age during the previous 7 day period. It can be administered by an interviewer or completed by the subject, however, validity and reliability may be increased with an interviewer (Dinger, Oman, Taylor, Vesely & Able, 2004).

UCLA Loneliness Scale- The scale was designed to assess feelings of loneliness that occur when relationships lack quality or quantity (Russell 1996; Russell, Peplau, & Cutrona, 1980). The scale had high test-retest reliability and internal consistency (Russell, 1996).

Vigorous Intensity Physical Activity- Activity that causes an increase in heart rate and rapid breathing.

Chapter II:

Review of Literature

Introduction

Depression can be a debilitating illness, causing suffering in all aspects of one's life. There are biochemical and physiological differences found in those with major depressive disorder, compared to those without, as well as an increased presence of depression with other diseases and disability. Exercise has health benefits and is known to decrease depressive symptoms and depression in adults (Singh et al., 2006).

Depression

Depression ranks fourth as a source of disease burden worldwide and affects more women than men (Bebbington et al, 1998; Usten, Ayuso-Mateos, Chatterji, Mathers & Murray, 2004). In 1990, the leading cause of disability worldwide was estimated to be depressive disorders, and accounted for 10.7% of the total years lived with disability (YLD) and in 2000 accounted for 12.1% of YLD. This pattern is seen throughout the world, however, in higher income nations the burden of depression is greater than lower and middle-income nations according to the Global Burden of Disease Study (Usten et al., 2004).

Depression is often related to chemical levels in the body and changes in cytokines (Huang & Lee, 2007; France, Lysaker & Robinson, 2007). Huang and Lee (2007) studied the effect of cytokine imbalance in patients suffering from major depressive disorder (MDD). Patients included 82 participants, 42 with MDD as determined by the DSM-IV and 40 healthy controls. Subjects were determined to be free of infection and chronic medical conditions and refrained from taking any medication for 2 weeks prior to the study. Following a 9 hour fast, cytokines IL-1α, TNF-α, and IL-10 were investigated. Using

analysis of covariance (ANCOVA), with adjustments for age and body mass index, no significant difference in IL-1α, TNF-α and IL-10 resulted. When adjusting only for BMI, significant differences were found in patients with MDD and increased TNF-α. Significantly higher levels in IL- 1α serum and IL- 1α /IL-10 ratio were found when adjusting for age and BMI in patients with melancholic features versus those without. The results of this study suggested that levels of TNF-α and IL-1α serum and also the ratio of IL-1α /IL-10 may play an important role in the onset of major depression.

Using magnetic resonance imaging (MRI) it is possible to determine the differences in the brain seen in individuals suffering from depressed mood compared to healthy individuals (Lavretsky et al., 2008). Two hundred seventy community-dwelling participants were recruited for the study by Lavretsky et al. (2008). Participants were excluded if they were under age 55, non-English speaking, or had a history of cortical strokes or severe illness, except cerebrovascular disease and dementia, and were taking medications that may affect cognition. They received a neurological medical history and examination as well as lab tests. MRI's were completed to determine volume of white matter, cortical gray matter, hypocampal volume, and the volume of lacunes within the thalamus, putamen, caudate, globus pallidus and white matter. At baseline, the subjects were diagnosed as cognitively intact, cognitively impaired, or having dementia. They were then rated as clinically depressed, having anhedonia, anergia, or apathy. All four symptoms affecting mood were associated with higher total volumes of lacunes in the white matter and putamen. In addition, a greater lacunar volume in the thalamus was associated with depressed mood. The authors conclude from this research that structural changes in the brain affect mood, which supports that cerebrovascular disease increases the pathogenesis of late life depression. In

conclusion, depression is related to chemical changes in the body as well as structural changes to the brain.

Measurement of depression

The Center for Epidemiologic Studies Depression Scale (CES-D)

The CES-D was developed to use in studies of depression in the general population (Radloff, 1977). Radloff (1977) reports that the scale can be used to measure current depression symptoms but cannot diagnose depression. The CES-D uses a self-report measure to determine how many symptoms of depression subjects had in the previous week with higher scores denoting more symptoms. The scale is for use comparing group averages of symptoms not degree of illness. The author concludes that the CES-D can be used in large populations to determine the prevalence of depressive symptoms for comparisons between groups.

Mojtabai and Olfson (2004) used the CES-D and Composite International Diagnostic Interview-Short Form (CIDI-SF) to determine factors associated with baseline depression or persistent depressive symptoms in older adults in follow up interviews. They found that having depressive symptoms at any one assessment was predictive of having significant depressive symptoms in the future. The results found that older adults who were at lower socioeconomic status, were a member of an ethnic minority, unemployed, physically ill or had little formal education also had higher depressive symptoms.

Depression and chronic disease

A higher prevalence of depression is seen among patients suffering from chronic respiratory conditions and this population also has a low frequency of treatment for their depressive symptoms, poorer survival, longer hospital stays, increased symptom burden and

poorer physical and social functioning (Kunik et al., 2005; Ng et al., 2007). The subjects in a 2005 study by Kunik et al. had received care within the last year with a chronic breathing disorder including bronchitis, emphysema, asthma, bronchiectasis, chronic airway obstruction or other respiratory condition. The subjects completed the Primary Care Evaluation of Mental Disorders (PRIME-MD) to assess psychological diagnoses and those who responded to one of the 2 depression questions and one of 3 anxiety questions were chosen as participants. Of the 444 patients who completed this portion of the study, 80% were found to have clinically significant levels of depression or anxiety. At the follow up, depression and anxiety were assessed with the Beck Depression Inventory (BDI) version 2 and Beck Anxiety Inventory (BAI). Subjects were further screened for psychotic and substance abuse disorders and level of treatment was determined for depression and anxiety. Of 204 subjects with chronic respiratory conditions and anxiety or depression only 31% were receiving treatment for depression; Forty-two (46%) and 28 (31%) of the 91 patients with severe depression and anxiety respectively were being treated properly. The authors reveal that depression and anxiety often go under diagnosed or under treated in patients with chronic respiratory disease.

Ng et al. (2007) investigated the role of depression on the outcome of chronic obstructive pulmonary disorder (COPD), by evaluating mortality, readmission to hospitals, smoking, burden on the respiratory system and physical and social functioning. Subjects were selected if they had been diagnosed with COPD, had a ratio of forced expiratory volume in 1 second (FEV1) to forced vital capacity (FVC) less than 70% and were a current or ex smoker. Two to four weeks after discharge the Hospital Anxiety and Depression Scale (HAD), the St. George Respiratory Questionnaire (SGRQ), spirometry, and level of caregiver

support were assessed. This was followed up with a home interview at 6 and 12 months past discharge in which vital status, re-hospitalization, smoking, HAD score, and SGRQ score were evaluated. The results characterized patients with depression as being older, living in lower end public housing, being divorced, widowed or single, living alone, having a lower BMI, had COPD for 5 years or more, receiving home oxygen care, having chronic mucus hyper excretion and a lower caregiver support scale. Those with depression had a higher rate of death (21%) after being discharged than non-depressed (10.5%), however, readmission was not significantly different. FEV1 and current smoking were not significantly different at baseline, however, smoking was less prevalent in non-depressed subjects at 6 months. Length of stay, total number of days of a year spent in the hospital, and SGRQ scores were worse in depressed individuals compared to non-depressed. The authors concluded that after controlling for severity and chronicity of disease, comorbidities, and behavioral, psychosocial and socioeconomic variables, depression in patients with acute exacerbation COPD increases mortality, increases length of hospital stay, smoking, symptom burden, poorer physical and social functioning and reduced quality of life.

An assessment of diabetes and depression has indicated that many patients with diabetes have symptoms of depression but not necessarily MDD. Fisher et al. (2007) evaluated subjects, aged 21-75, with a diagnosis of type 2 diabetes with no severe complications of diabetes, and who could fluently read or speak English or Spanish. Depression was measured using the Composite International Diagnostic Interview (CIDI) and the CES-D-20 questionnaire to determine depressive symptoms in the past week while emotional stress caused by diabetes was measured by the Diabetes Distress Scale (DDS). A total of 506 patients completed the testing. The findings of the CES-D were that 113 (22%)

scored over 16 on the scale and 75 (15%) scored over 22, however 33 and 23 respectively received a diagnosis of MDD resulting in 70% of the patients with CES-D scores of higher depression were not clinically depressed. Of the 56 patients with MDD, 31 were currently being treated with a psychotropic medication. The patients with MDD had a higher BMI, more co-morbidities and took more psychotropic medication than those without. The Diabetes Distress Scale was significantly associated with CES-D leading the authors to conclude that higher CES-D scores among type 2 diabetics may be related to the distress caused as a result of the management of disease rather than depression.

Depression related to metabolic syndrome (MS) and its components have been shown to be gender dependent (Toker, Shirom & Melamed, 2008). A sample of 3,880 apparently healthy individuals participating in the Tel Aviv Medical Center Inflammation Survey completed a questionnaire covering occupational, psychological and physical background morbidity factors as well as the Patient Health Questionnaire to measure depression. Metabolic syndrome is defined as having three or more of the following components; central obesity with a waist measurement over 102 cm (men) or 88 cm (women), fasting blood triglycerides over 150 mg/dL, HDL below 40 mg/dL (men) or 50 mg/dL (women), blood pressure over 130/85 mmHg or taking medication for hypertension, and fasting glucose over 110 mg/dL. The results of the survey indicated that depression was positively correlated with increased waist circumference, triglycerides, fasting glucose and low HDL in women while only waist circumference was positively correlated in men. The authors concluded that depression was associated with a higher risk of having MS in women but not among men. In conclusion those suffering from disease are also at increased risk for depressive symptoms.

Depression in populations with other health problems often goes under diagnosed and increases the risk of complications and increased time spent in the hospital.

Depression and older adults

Depression is not only a cause of major disability but can also result from disability. Penninx et al. (1998) collected data from the Established Population for Epidemiologic Studies of the Elderly (EPESE), which consists of adults aged 65 and older, living in Iowa. Data was collected over an 8 month period in 1981-1982 with follow ups each year for the following 6 years and again 10 years later. Twelve hundred and eighty six subjects from the original 3673 met the criteria for inclusion and were still living at the 10 year follow-up interview.

Depression was assessed by Penninx and associates (1998) using the 11 item CES-D and mean scores for men and women were created by standardizing scores against the 1974-1975 National Health and Nutrition Survey I (NHANES I). A score of 20 was used as a cutoff for depressive mood for this study. Physical performance was tested by measuring standing balance, walking speed, and the ability to rise from a chair. The overall performance was rated on a scale of 0-12 with higher scores indicating better performance. Baseline health was also evaluated by collecting information on smoking status, alcohol consumption, BMI, and blood pressure. Disease was indicated if they had ever been told they had a disease or had a hospital discharge diagnoses within the last 3 years for a disease. Physical disability was self-assessed using the Rosow-Breslau scale reporting difficulty with disability of reports of disability with activities of daily living. The results of this study indicated that 10.7% of the subjects scored over 20 on the CES-D and those with depression had lower baseline physical functioning scores that those without depression (6.9 vs. 8.3,

P<.001). At the follow-up 4 years later, physical functioning scores continued to be lower among depressed individuals. The decline in performance was greatest in the oldest, less educated, unmarried, and patients with coronary heart disease and lung disease. Depressed patients had a larger decline than non-depressed patients. The authors concluded that depressive symptoms and a depressed mood increased the risk of experiencing a decline in physical performance and increase in self-reported physical disability.

The use of antidepressants by older adults was examined to determine what factors contribute to the use or disuse of the medication (Lakey, Gray, Ciechanowski, Schwartz & LoGerfo, 2008). A total of 138 adults over sixty years old (mean 73.0) who had symptoms of depression or dysthymia, as determined by the DSM-IV, completed the entire study to determine antidepressant use. Subjects were interviewed in their homes at baseline, 6 months and 12 months. Socioeconomic status, age, sex, living situation, educational status and annual household income were reported. Participants were asked if they had any of the following chronic conditions in the last 3 years; pulmonary conditions, hypertension, diabetes or high blood sugar, arthritis, hearing or vision loss, cancer, heart disease, chronic pain, any stomach condition and chronic bladder or prostate problems. Health status was determined by asking whether health was poor, fair, good, very good, or excellent, as well as determining how much, if any assistance was needed performing activities of daily living. Exercise was determined using the Community Health Activities Model Program for Seniors questionnaire. Medications taken in the 2 weeks prior to each visit were recorded and the total daily dose of antidepressants was calculated. The results indicated that 71.7% of the subjects lived alone, 56.5% had an annual household income under $10,000, 56.5% reported their health as fair/poor and 33.3% reported engaging in moderate activity during the week

which included walking briskly, jogging, dancing, golfing, heavy housework, gardening, bicycling, doing aerobics, playing tennis or swimming. The mean number of chronic conditions was 4.6. Forty seven subjects were currently being treated for depression or had been treated in the last year, while 55% (76) indicated they had been treated for depression previously. At baseline 36.2% of participants were using antidepressants, 36.1% at 6 months and 35.7% at 12 months. The factors that most contributed to baseline antidepressant use were lower age, requiring more assistance with activities of daily living, decreased probability of engaging in moderate exercise, more visits to a mental health provider in the past 6 months, currently using sedatives or anxiolytics and taking a higher number of other prescription medication.

Older adults with depression are more likely to stop attending physical activity programs than non-depressed older adults, while the groups were equally likely to join the programs. In a study of 8,269 older adults enrolled in the Group Health Cooperative's physical fitness program Silver Sneakers, Nguyen at al. 2008 determined the likelihood of depressed older adults to join, and the extent to which they participated after joining and the effect of exercise on depression. At the start of the study 6.8% of the Silver Sneakers participants were depressed, according to diagnostic codes obtained from outpatient visits to physicians, but enrollment in the program was not affected by depression. The non-depressed participants completed more exercise sessions than the depressed individuals. Program attrition after the 15th month through the 24th month was greater among depressed individuals with an overall 19% increased risk in lapse. The recommended physical activity level of 5 visits per week was met by only 3% of non-depressed and 1% of depressed, however, those who visited at least 2 days per week had a 46% reduction in depression risk

in the second year of the study. More visits were also associated with less depressive symptoms but the effect was significant only in the non-depressed individuals. The results of the study indicate that depressed older adults are as likely to enroll in a physical activity program as non-depressed individuals, however, they were less likely to adhere to a program. Also, exercise was shown to reduce depressive symptoms in both depressed and non-depressed individuals.

The UPLIFT study revealed that it is possible to recruit depressed older adults to participate in resistance training (Sims et al., 2006). Subjects were over 65 and completed the Geriatric Depression Scale and Physical Activity Readiness Questionnaire (PARQ). Those currently taking antidepressants were excluded along with alcohol and drug related depression, depression with psychotic features, diagnoses of other psychiatric disorders, dementia, suicidal thoughts, terminal illness, uncontrolled hypertension or unstable angina or diabetes. At baseline, 10 weeks and 6 months, the Geriatric Depression Scale and PARQ were re-administered to determine changes. The exercise program consisted of three sessions per week for 10 weeks of progressive resistance training. Fifty seven percent of participants attended at least 60% of the sessions, which was similar to adherence rates of antidepressant medications.

Older adults in the US are at risk for the greatest increase in depression as the population ages and continues to live longer. Women aged 50-54 and men aged 55-59 currently have the highest prevalence of depression, however older adults are at particular risk because depression is associated with increased mortality (Heo et al., 2008; Murphy et al., 2008). In adults over 60 years of age with arthritis and co-morbid depression, reduction in depression as diagnosed by their physician was associated with increased function and

decreased pain (Lin et al., 2003). While older adults do not have the highest rates of depression in comparison to other age groups, reducing depression is important in increasing functioning and decreasing risk of disease or mortality.

Depression and personality traits or mood

The Big Five personality traits are neuroticism, extraversion, openness, conscientiousness and agreeableness (Brown & Schinka, 2005; Soldz, 1999). Research by Brown and Schinka (2005) showed that subjects with greater depressive characteristics, according to an interviewer, also had greater negative aspects of personality. The negative aspects of personality included low scores in extraversion, agreeableness, and conscientiousness (Brown & Schinka, 2005).

In a 45-year longitudinal study the changes in the Big Five characteristics in men were followed and rated from -3 to +3 for all the traits being studied (Soldz & Vaillant, 1999). The personality traits were compared to a number of variables chosen including creativity, social relations, career functioning and mental health, which included depression. In college-aged subjects, depression and neuroticism were correlated at $r = 0.22$ ($p < 0.01$) and $r = 0.36$ throughout the span of the study ($p < 0.001$). The authors note that neuroticism in late midlife was a good correlate to genetic vulnerability to depression and alcoholism. This research shows that personality traits of an individual may affect the amount of depressive symptoms they experience.

In addition to the Big Five personality traits, negative and positive affect, as well as, personality type have an effect on mood disorders, depression and physical health (Denollet, 2005; McLaughlin, Borkovec & Sibrava, 2007). Older adults with higher positive affect are shown to have lower depressive levels and those with higher negative affect have poorer

functional status and more depressive symptoms (Hong, Zarit, & Malmberg, 2004). A study by Hu and Gruber (2008) evaluated Geriatric Depression Scale, Instrumental Activities of Daily Living (IADL), Symptom Distress Scale (SDS), Positive and Negative Affect Schedule (PANAS), and Medical Outcomes Study Short Form 36 to measure health related quality of life. High positive affect (HPA) would represent more optimistic outlook on life while low positive affect (LPA) represents more pessimistic outlook. High negative affect (HNA) represents emotional distress while low negative affect (LNA) represents calmness. Overall health status was shown to be highest in the HPA/LNA groups, while the HNA group reported the highest depressive symptoms and lower levels of physical and mental health related quality of life. The authors state that those with higher positive affect and lower negative affect had lower levels of distress, depressive symptoms, higher levels of activity and higher perceived physical and mental health. The authors concluded that awareness of older adults affect can be useful when undergoing treatment for chronic illness and support can be provided to increase positive affect (Badger, Segrin, Meek, Lopez & Bonham, 2005; Stewart, Craig, MacPherson & Alexander, 2001).

Personality traits and age have been shown to be related to depression (Trouillet & Gana, 2008). In a cross-sectional study involving 466 community living adults, subjects were divided into four age groups (18-30, 31-49, 50-69, and 70-94 years old). The personality traits examined included: novelty seeking, harm avoidance, reward dependence, persistence, self-transcendence, cooperativeness and self-D, which encompasses self-acceptance, responsibility and cooperation. The HAD scale and the Temperament and Character Inventory (TCI) self-questionnaire were administered to determine depression and anxiety. Comparisons between age groups revealed that different predictors were identified

in each age group. In the 18-30 and 31-49 age groups harm avoidance was a strong predictor of depression. In the 50-79 age group, depression was positively correlated with harm avoidance and negatively with self-transcendence, which is the tendency to feel at one with the universe and nature. In the 70-94 age group, depression was predicted with the TCI dimensions. The authors concluded that over the lifespan the predictors of depression change.

Current exercise has been shown to influence the mental and physical health of depressed patients. Subjects in a study by Sylvia et al. (2009) completed the BDI-II, and Exercise Questionnaire and Automatic Thoughts Questionnaire (ATQ) on their first day in a treatment program. The ATQ is a self-report questionnaire in which subjects report on negative thoughts in 30 questions. The results indicated that the frequency and duration of exercise in the past year did not predict BDI-II or ATQ scores, however, those who were currently exercising prior to entry had lower BDI-II scores but not ATQ scores. The exercise questionnaire for this group indicated that 50% of the subjects exercised less than once per week in the past year. The authors state that in this group of depressed adults, those who were currently exercising were experiencing decreased depressive symptoms and lower body mass index. In addition, according to the results of the exercise questionnaire the subjects stated that they would be willing to exercise for an average of 55 minutes, 5 days per week, meeting the ACSM recommendation for exercise. The authors concluded that exercise programs are important to patients undergoing treatment for depression to possibly aid in recovery. In conclusion, personality traits and mood can be associated with increased depression as well as the predictors of depressive symptoms.

Positive and Negative Affect Schedule

The PANAS was developed from two mood scales, one measures positive affect while the other measures negative affect for use in group studies (Watson et al., 1988). The items are scales from 1 being very slightly to 5 being extremely, indicating the way the subject has felt this way in the past days, weeks or months (Watson et al., 1988). The results are two scores, one for positive affect and one for negative affect. Positive affect is the subject's tendency to feel enthusiastic, energetic and alert, while negative affect reflects distress (Watson et al., 1988). The internal consistency ranged from 0.81 to 0.89 for positive affect and 0.83 to 0.88 negative affect (Watson & Clark, 1992).

When comparing the PANAS to the Hospital Anxiety and Depression Scale positive affect had a greater correlation to depression ($r = -0.52$) than negative affect (0.44) (Crawford & Henry, 2004). Crawford and Henry reported a reliability of 0.89 for positive affect and 0.85 for negative affect, using Cronbach's α. They also suggest using the PANAS as a supplement to depression scales.

Quality of life

Quality of life is the conscious judgment of the satisfaction with one's life in such areas as health, physical function, social relations, and standard of living (Pavot & Diener, 1993). In a review of articles researching the effect of exercise on quality of life the authors concluded that more than the physical act of exercising, the way the program is run and the participants' participation in designing the program are important in improving quality of life (Rejeski & Mihalko, 2001).

Health related quality of life (HRQOL) studies the impact of perceived health as determined by physical, emotional and social functioning and is often studied in relationship

to disease or disability including mental health. In a 2009 study by Gallegos-Carrillo et al. the influence of depressive symptoms using the Geriatric Depression Scale on HRQOL Short Form 36 in community-dwelling older adults with chronic co-morbidities was studied. The HRQOL SF-36 scale combines mental and physical functioning questions, but does not have a cutoff score to differentiate between good and poor scores and instead uses a continuous measure. Subjects in this study also reported information on health problems in the past 4 weeks and completed the Geriatric Depression Scale using a cutoff of 6 as a score for having depressive symptoms. The results showed that subjects with depressive symptoms were older, female, less educated, were widows or widowers, and did not perform any physical activity. Only 5% of those subjects without any chronic diseases had symptoms of depression and of all the subjects with depressive symptoms 7% engaged in physical activity. The authors state that having depressive symptoms along with chronic comorbid disease decreases HRQOL in older community-dwelling adults. Gallegos-Carrillo and colleagues conclude that these results indicate that among older adults with chronic disease the detection and management of depressive symptoms should be a health priority as treatment could improve their HRQOL and maintain their physical and mental functioning.

Social networks and HRQOL were studied in older adults with and without depressive symptoms to determine if a relationship existed (Gallegos-Carrillo et al., 2009). The authors used the HRQOL SF-36, Geriatric Depression Scale and a measure of social networks including marital status, living status (alone, or not alone), size of network of close relatives and size of network of friends. A group of 2,788 adults aged 60 years or older in Mexico were studied. There were 1,418 subjects with depressive symptoms while the control was 1,370 without depressive symptoms. In both groups the subjects' social

networks impacted the HRQOL, and specifically marital status, living status and size of the network of close relatives they had. The HRQOL scores in the study group were lower than the control group, however, the married subjects in the study group had higher scores in the physical functioning, role-physical, and bodily pain portion of the HRQOL than the non-married group, and the married control group members scored better on the social functioning than their non-married counterparts. Also, as the number of relatives and friends in the subject's social group increased the HRQOL scores tended to increase for both the study and control group. The authors concluded that social networks including a spouse and network of close friends and relatives can decrease the effect of depression on HRQOL.

In conclusion, the influence of a social network on depression and depressive symptoms reveals that those with close friends and relatives, including a spouse, may be better able to mitigate the effects of depression on their HRQOL. Both physical and mental health function are maintained through social, leisure and daily living activities, supporting the need for keeping up activity levels into older adulthood to contribute to successful aging (Everard, Lach, Fisher & Baum, 2000).

UCLA Loneliness Scale Version 3

The UCLA LS is a 20 item scale with each item being rated from 1 being never to 4 being often (Russell, 1996). It is a commonly used self-report measure that is used to report subjects' satisfaction with social relationships (Luanaigh & Lawlor, 2008). The scale is not used in conjunction with a particular time frame as depression scales are, so it remains unclear whether the UCLA Loneliness Scale measures state or trait (Luanaigh & Lawlor, 2008). The scale does have high internal consistency ($\alpha = 0.92$) and test reliability ($r = 0.73$) after 12 months (Russell, 1996).

When using the original scale with the elderly, the use of double negatives was a cause of common confusion. However, in the revised version 3 the use of double negatives was removed and, in the elderly, the test-retest correlation was 0.73 after 12 months (Russell, 1996). A paired t-test revealed no significant change in loneliness over the year period (Russell, 1996).

Measurement of physical activity- Physical Activity Scale for the Elderly

The Physical Activity Scale for the Elderly was developed to assess the weekly physical activity of adults over 65 years old. The scale evaluates physical activity during the previous 7 day period. It can be administered by an interviewer or completed by the subject, however, validity and reliability may be increased with an interviewer (Dinger et al., 2004). A portable accelerometer (Computer Science and Applications, Inc. Actigraph Monitor Model 7164, Shalimar, FL) was used over the course of 7 days during all waking hours to determine relative oxygen consumption correlation with energy expenditure (Dinger et al., 2004). Summing the PASE score for all categories of activity (leisure-time, household, occupational) reports the physical activity level of the older adult. The results of the study by Dinger et al. (2004) reveal the correlation between PASE and Actigraph readings, which substantiate the validity of PASE in less active older adults. The survey was determined valid by comparing the physical activity reported with readings from the accelerometer (Washburn & Ficker, 1999). Over the course of three consecutive days of monitoring, followed by completion of PASE, the results indicated that the scores were significantly correlated in the sample.

Physical activity, depression and older adults

Participation in physical activity affects the moods of older adults. Sedentary older women aged 60-75 years old were recruited as subjects in the study by Matsuoka et al. (2005). To assess the feelings of the subjects, researchers used the 12 item Exercise-Induced Feeling Inventory. The 12-week study divided subjects into 4 groups, a control group and 3 exercise groups participating in exercise 3 times, 2 times or 1 time per week. Subjects were excluded for severe cardiovascular problems, respiratory disease, neurological disease or severe orthopedic problems. The training consisted of 5 minutes of warm up, 15 minutes of conditioning, 5 minutes of lower body exercise, 5 minutes for upper body exercise, 10 minutes of recreational activity and 5 minutes of cool down with exercise intensity varying from 50-75% of heart rate max. The pre-test and post-test measures revealed that differences were seen in the three times per week group, as well as the two times per week group, but none in the once per week and control group. These 2 groups had increased mood state and produced a more positive mood after completion of the 12-week exercise program. The authors concluded that exercise is required 2 or 3 times per week in older adults to enhance the mood of the participants.

Depressed older adults suffering from Alzheimer's disease (AD) had reduced depression with an exercise training program. Williams and Tappen (2008) used 45 adults who had been diagnosed with AD using the National Institute of Neurological and Communicative Disorders and Stroke- Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) criteria and the Cornell Scale for Depression in Dementia (CSDD) to measure depressed mood with a score of 7 or higher indicating depressed mood. Subjects were residents of long-term care facilities, based on the NINCDS-ADRDA had AD,

and were dependent in one of the following; bed mobility, transfers, gait or balance, had the ability to walk without assistance, and a CSDD score above 7. The exercise intervention lasted 16 weeks and was administered at the individual's nursing home in 5 sessions per week that increased up to 30 minutes of exercise over the first 4 weeks and then remained steady. Subjects were randomly assigned to the exercise, walking, or control group that engaged in social conversation for the intervention. The exercise group began with 10 minutes of strength, balance and flexibility using exercises such as knee bends, toe rises, push pulls, and side stepping. Each participant began with 3 repetitions per session increasing by 2 each week until they reached 9. Strength, balance and flexibility were followed by walking which progressed to 20 minutes over the course of the intervention. The walking intervention group walked, with assistance if needed, at their own pace, stopping for rest as needed and building up to 30 minutes while the control group engaged in casual conversation for 30 minutes. Using one-way ANOVA no significant differences were found between age, length of stay and CSDD scores of participants. Pre-test CSDD scores had a mean of 9.77 ± 6.73 with no subject under 7 as previously mentioned, while at post test 35% of participants had scores under 7. Both the walking group and exercise group had significant changes in the Alzheimer's Mood Scale Negative Mood Subscale while the conversation group did not. The results of this study show that all three groups had decreases in depressive scores and exercise could be used as an effective tool for decreasing depression as well as improving overall health of older adults with AD.

Adult patients with MDD can use exercise to reduce depressive symptoms and lower the severity of further episodes of depression. In a study by Babyak et al. (2000) participants met the DSM-IV criteria for MDD and were over the age of 50. Participants were excluded if

they were currently taking antidepressant medications, taking any medication that would preclude them from being assigned to the exercise group, current alcohol or substance abuse, medical contraindications to exercise, other psychiatric diagnosis except depression, currently in psychotherapy, suicidal or currently participating in regular aerobic exercise. A total 133 patients completed the intervention, which consisted of an exercise, medication, and combination exercise and medication groups. The exercise intervention was 30 minutes of aerobic exercise at 70-85% of HRR 3 days per week; medication consisted of taking Zoloft, a serotonin-reuptake inhibitor and the combination group was an alliance of both. Depression was determined using the Hamilton Rating Scale for Depression (HRSD) and the BDI. Evaluations were completed at baseline, immediately after the treatment period, and 6 months after the end of the intervention. Similar remission from depression was seen among all the intervention groups at 60.4% in the exercise group, 65.5% in the medication group and 68.8% in the combination group. Six months after the end of the intervention 30% of the participants from the exercise group received a diagnosis of MDD compared to 52% in the medication group and 55% of the combination group. These findings revealed that 6 months post intervention exercise was most effective in recovery from MDD.

Exercise and antidepressants have proven to improve the symptoms of depression in older adults, however, the extent to which they act has not been compared. A study by Blumenthal et al. (1999) evaluated 150 men and women over the age of 50 with MDD and compared the effect of antidepressants, exercise and a combination of both to determine which had the greatest effect in decreasing depressive symptoms. The HRSD used by a clinical psychologist determined the presence and severity of depression. Subjects underwent a symptom limited graded exercise test using the Balke Protocol to determine

aerobic capacity. The adults were randomly assigned to one of the three treatment groups. The medication group was administered an antidepressant, Sertaline. The exercise group took part in 3 supervised sessions per week for 16 weeks. Subjects trained at 70-85% of heart rate reserve for 30 minutes, each exercise session was preceded with a 10 minute warm up and followed by a 5 minute cool down. The combined group took part in both interventions. The adherence rates were similar between each group. The results of this study show that all three groups saw a reduction in depressive symptoms from baseline to 16 weeks and the difference between the groups was not significant. Depressed patients in the medication group had the fastest rate of decline in depressive symptoms within the first few weeks of treatment. Mildly depressed patients in the combination group responded more quickly to the intervention than moderate and severely depressed and responded fastest to the combination therapy overall. The authors concluded that exercise proved to be as effective as medication or a combination treatment after a 16 week intervention in reducing depressive symptoms as 60.4% of the exercise group, 68.8% of the medication group and 65.5% of the combination group no longer met the diagnoses for clinical depression.

The study by Motl et al. (2005) examined the effects of exercise over a longer time period (5 years) to determine changes in depression. Participants of the study by Motl et al. (2005) were 174 older adults, aged 60-75, whom were sedentary, healthy and able to participate in exercise testing, had physician's clearance, adequate mental status and were willing to be randomly assigned to a treatment group. Participants were assigned to either a walking or low intensity resistance/flexibility group. The walking group followed ACSM guidelines for exercise 3 times per week for 6 months progressing from 50-55% VO2peak to 65% VO2 peak for durations lasting between 10-15 minutes initially, progressing to 40-45

minutes. Depression was measured using the 30 item Geriatric Depression Scale. Physical self-esteem was measured using the Physical Self-Perception Profile (PSPP) to assess self-esteem in relation to physical functioning. Measures were reported at baseline, immediately following the 6-month intervention, and at 12 months and 60 months post intervention. The results of the intervention revealed that depressive symptom scores declined immediately following the intervention, and were sustained at the 12 and 60 month follow-up. The reductions at these time points were -0.26, -0.18, and -0.29 respectively, in comparison to baseline. The results of this study were not significant, however, previous research described in this review indicate that exercise can reduce depressive symptoms as well as increasing cardiorespiratory fitness, but is not necessary when attempting to decrease depression symptoms.

Goodwin (2003) has reported that adults who get regular physical activity decreased their likelihood of having MDD. Goodwin used the National Comorbidity Survey of adults aged 15-54 from 1990-1992 with a primary focus of determining prevalence of symptoms of depression. Subjects were diagnosed using the World Health Organization Composite International Diagnostic Interview for psychiatric disorders, as well as physical disorders or disability. The physical activity levels were determined using an interview by asking participants how often they exercised. The results revealed that 60.3% of adults reported getting regular physical exercise. Those subjects who reported regular physical activity had decreased MDD, agoraphobia, panic attacks, generalized anxiety disorder, specific phobia, and social phobia. The author concluded that physical activity was associated with lower risk of depression in adults.

Depression has biochemical effects on the body and, while the mechanisms are not fully understood, changes in hormonal excretions may play a large part in depression (Nabkasorn et al., 2005). Fifty-nine female volunteers aged 18-20 took part in a 16 week exercise intervention, CES-D survey, urinalysis and cardiorespiratory testing to determine what effect the exercise training had. Subjects were placed in either group A or group B, with group A beginning an 8 week exercise program consisting of jogging 5 days per week for 50 minutes at 50% or less of maximal heart rate reserve while group B maintained daily activity. At the end of eight weeks the groups switched. Subjects completed the CES-D every 4 weeks with urinalysis and cardiorespiratory testing at baseline and at the end of 8 and 16 weeks. The final cohort of 49 subjects showed no significant difference in baseline CES-D score, which decreased in group A during the training phase and gradually increased, but remained significantly below baseline during the daily activity phase. In group B the score remained constant for the daily activity phase and decreased during the training phase. Cortisol and epinephrine decreased significantly with training in both groups along with resting heart rate, while peak VO2, and lung capacity increased. The decrease in urine epinephrine may be associated with the subjects decreased resting heart rate resulting in a decreased cardiovascular response to psychological stress. While the exact mechanisms on how hormones effect depression are unknown, the results indicated that physical activity decreased depressive symptoms, urine cortisol and epinephrine in young women.

Exercise has been shown to be beneficial in reducing depression and has been suggested to be used over time as a preventive measure to fight depression. The Rancho Bernardo Study, by Kritz- Silverstein et al. (2001) enrolled 82% of the residents between the age of 50-89 years in Rancho Bernardo between 1972 and 1974 in a heart disease risk factor

study. They were white middle class men and women who took part in the initial clinical evaluation and follow-ups between 1984-1987 and 1992 and 1995. In the latter two visits the subjects completed the BDI to assess mood and information on physical activity, amount, and intensity. In 1984-1987, 932 men and 1,097 women participants took part after excluding for depression (BDI>13) or extreme physical limitation. Of that group 404 men and 540 women were in the final analyses after completing the BDI between 1992 and 1995. Eighty-five percent of the men and 81% of the women reported regular exercise 3 times per week. After adjusting for age, both men and women who participated in regular strenuous exercise had significantly lower BDI scores ($p<0.01$), and likewise men and women participating in exercise 3 or more days per week ($p<0.05$) also experienced lower BDI. Men participating in regular exercise at baseline and in the follow up had the lowest BDI; followed by those who did not participate at baseline but did in the follow-up. Those who did not exercise regularly had the highest BDI. The authors concluded that exercise does reduce depressed mood among older adults.

Physical activity has proven to reduce depression, and the favorable effect of exercise on depressed individuals over a long-term has protective effects against depression. Strawbridge et al. (2002) recruited subjects from the Alameda County Study that follows 6,928 adults originally started in 1965. A total of 1,947 completed the entire study. A physical activity scale was developed based on frequency of activity, taking part in active sports, taking long walks and swimming. The scale uses responses of never, sometimes, and often, scored as zero, one, or two respectively. The mean score was 3.4, with the highest possible score of 8. Depression was measured with the DSM-12D based on the DSM-IV. The DSM-12D was a measure of diagnosing depression created from the diagnostic criteria

outlined in the Diagnostic and Statistical Manual of Mental Disorders. Disability and covariates including financial problems, chronic conditions, neighborhood problems, health behaviors and social relations were reported. The results of Strawbridge et al. (2002) reveal that those among the low and medium physically active were more likely to be depressed than the highly active. Physical disability increased risk of depression 4 times compared to those without impaired mobility. Compared to 1999, a one-point increase in physical activity in 1994 reduced the likelihood of depression in 1999 by 20%. They concluded that depression worsens with physical impairment but symptoms are reduced with physical activity or a history of physical activity.

Physical activity reduces depressive symptoms, however, the exact dose, domain and social aspect of physical activity in depressed women to optimize anti-depressant has not been extensively studied. Teychenne et al. (2008) determined exercise levels, intensity, and current depressive symptoms in a sample of 1,501 women between the ages of 18 and 65. They were randomly selected from 45 suburbs, which were chosen based on the socioeconomic status of their suburbs in order to achieve a varied distribution. Women were mailed either a physical activity survey or a healthy eating survey and the sample was taken from those who replied and who indicated on their response that they were not pregnant. To determine physical activity levels participants self- reported on the International Physical Activity Questionnaire (IPAQ-L), recalling frequency and intensity (moderate or vigorous) of activities including leisure time, transportation related activity, work related activity and household activity for the previous seven days. Activity levels were determined by totaling both the amount of time completing physical activity in each domain and also the amount of time at each intensity level. Subjects reported on the social context of the activities by

reporting how often they participated in the physical activity with family or friends, whether they were encouraged or discouraged from physical activity, and other questions relating the social aspects of activity. The mental health aspect was measured, using the 30-item version of the General Health Questionnaire, to determine if depressive symptoms had been present within the last couple of weeks. Depressive symptoms were indicated by scores greater than 4 in this study. A total of 421 (30%) participants were classified as currently experiencing depressive symptoms, which is similar to the national average of 24% of women in Australia, reported by Teychenne and associates from the Department of Human Services (Department of Human Services, 2004). The results of this research demonstrated that women who participated in walking or moderate intensity physical activity were less likely to experience depressive symptoms ($p = 0.027$ and $p = 0.048$ respectively). This was supported by 22% of those who took part in 1.5 hours of moderate physical activity having depressive symptoms, compared to 31% of those who reported no moderate intensity leisure time activity. Furthermore, being discouraged from physical activity and not having someone to be active with was associated with increased depressive symptoms ($p = 0.002$ and $p = 0.037$ respectively), while having someone to be active with, being a part of a club or being active with a family member was associated with less depressive symptoms ($p = 0.037$, $p = 0.044$, and $p = 0.011$ respectively). The intensity of the activity revealed that compared to those with no vigorous leisure time activity those with the highest level of vigorous activity (>1.75 hours per week) had lower odds of depression, and those with no moderate leisure time activity had higher odds of depression compared to those with the highest moderate levels of leisure time activity (>1.5 hours per week). The authors of this study concluded that while the overall physical activity dose had no significant effect on depressive symptoms, the

intensity of the physical activity as well as being active with a family member did lower the odds of depressive symptoms.

Dunn et al. (2005) recruited 80 sedentary subjects aged 20-45 years old who were suffering from mild to moderate depression according to DSM-IV, using the Structured Clinical Interview for Depression (SCID) and HRSD scale to determine the change in depression. The exercise program used a 2 x 2 design plus a control group, with the factors being total weekly energy expenditure and frequency. The energy expenditure was either a low dose (7kcal/kg/week) or public health dose (17.5kcal/kg/week) with a frequency of 3 or 5 days per week. The groups were then a low dose (LD) 3 days, LD 5 days, public health dose (PHD) 3 days or PHD 5 days per week for 12 weeks. Seventy-two subjects started the treatment and completed the HRSD scale each week. The baseline HRSD score was 16.2 and the final scores were reduced 47% for the PHD, 30% for LD 3, 38% for LD 5 and 29% for the control group. With respect to days per week, age, and gender there was no significant difference in reducing depression. The results of this research showed that the dose of 17kcal/kg/week of energy expenditure in either 3 or 5 days was sufficient to reduce depressive symptoms to below the criteria for depression as defined by HRSD in 42% of the subjects. In contrast, a lower dose of 7kcal/kg/week subjects had the same response as the control group.

A 24-week study of 28 older adults participating in a resistance training program showed that this training increased mood in participants (McLafferty, Wetzstein, & Hunter, 2004). Prior to the start of the study subjects' body composition, muscle strength and Profile of Mood States (POMS) were assessed as well as at the completion of the training program. Upon completion of the program subjects had no significant changes in weight or BMI, but

did have a significant decrease in body fat percent (2.5%, $p < .001$), and strength, which on average increased by 41.9%. The POMS reported raw scores for tension, anger, confusion, fatigue, vigor, and depression as well as overall scores. Overall, subjects had a significant improvement in scores for confusion, tension, anger and total mood scores, but not for fatigue, vigor and depression. An unexpected result of this study was that subjects did not have a significant change in depression. However the subjects started with low depression scores and it seemed unlikely for them to decrease further. The authors also note that 16 of 23 subjects interviewed reported a change in mood as a result of resistance training.

In clinically depressed subjects, physical activity levels were correlated with depression levels over a 10-year period (Harris, Cronkite & Moos, 2006). Subjects in the study were adults over 18 (mean 39.9) years of age entering facilities for depression treatment. Depression diagnosis was determined using the Research Diagnostic Criteria (RDC) and depression severity with the Global Depression Index (GDI) using 10 criteria for MDD and 8 criteria for minor depression. Physical activity levels were obtained by administering the Physical Activity Index (PAI) to determine whether patients engaged in 2 activities with friends or family. Patients' exercise coping was determined by scaling from 0 (never) - 3 (fairly often) whether they used exercise to cope with stressful life events or problems within the last 12 months. Physical activity, exercise coping and global depression were reported at baseline, 1 year, 4 years and 10 years with 395, 370, and 313 participants respectively. Results were reported in global depression points. With each level of increased physical activity depression was reduced by 0.90 points, however each medical condition increased the score by 3.27 points. Therefore, a highly active person with two medical conditions would have a much lower global depression score than a sedentary person with

two medical conditions. Negative events were associated with a 3.90 point increase, while physical activity decreased the score by 0.89 points. Exercise coping at higher levels was associated with decreased levels of depression as exercise coping was associated with a 1.23 decrease in depression. The authors concluded that over 10 years, exercise proved to be effective in reducing depression levels, especially in relation to major stressful life events and medical problems.

Yoga and mindful training

Yoga, a mindful exercise combines meditative mindfulness with slow moving or static muscular exercise (Netz & Lidor, 2003). This type of physical activity, including t'ai chi, yoga, Qigong and Feldenkrais, uses breathing as a key focal point during participation and improves the mood of participants immediately following completion of a session (Johansson & Hassmén, 2008, Netz & Lidor, 2003). The breathing style used in Sudarshan Kriya yoga (SKY) follows a specific pattern of breathing involving ujjayi, bhastrika, om chanting and Sudarshan Kriya in which the participant is sitting with the spine erect allowing for deep breathing (Brown & Gerbarg, 2005). In 2000, Janakiramaiah and associates completed a study of 45 inpatient subjects with depression scores on the HRSD of 17 or greater and they completed the BDI. The subjects were randomly placed into 3 groups. The groups were to receive SKY, electroconvulsive therapy (ECT) or medicinal treatment with imipramine (IMN) for 4 weeks. The SKY treatment was 45 minutes per day, 6 days per week, the ECT was completed 3 times per week and the IMN was taken daily. Depression was monitored using the BDI and HRSD before treatment and weekly during treatment. The remission rate for depression using SKY was as high as 67% among sufferers of melancholic

depression after a four-week intervention, which was comparable to the use of imipramine, a psychotropic drug (Janakiramaiah et al., 2000).

Yoga has an immediate effect on depression and mood (Woolery, Myers, Sternlieb & Zeltzer, 2004). Woolery et al. (2004) studied the effect of Iyengar yoga on mildly depressed subjects enrolled in 2 one-hour classes per week, for 5 weeks. The subjects were assessed as mildly depressed after completing the BDI, the Spielberger Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS). These tests were administered at baseline, after class 1, class 5, and the final class. Cortisol samples were also collected at pretest, mid way through and upon completion of the intervention. The control group was asked to maintain their daily routine and not do yoga or other mindful exercise programs. The results of this study revealed no difference at baseline in depression, anxiety, interest in yoga, motivation to attend yoga, or expected benefits of yoga. The depression ratings at 5 weeks were lower in the yoga group but were not in the control group. To ensure that changes in depression were not a result of decreased anxiety a Pearson correlation was completed and revealed that decreased depression was not significantly related to decreased anxiety. Pre class and post class data show that subjects had reduced depression and anxiety. Morning cortisol levels had a trend of increasing at the end of treatment in the yoga group but no significant difference was seen at mid-course or baseline. The authors report that symptoms of depression can be lowered with yoga in as little as one session and the reduction is most pronounced through the middle and end of the yoga course.

Yoga has many beneficial effects on depression (Shapiro et al., 2007). Biological, psychological, and emotional changes have been shown in subjects diagnosed with unipolar depression using the criteria from the Mini-International Neuropsychiatric Interview and the

Hamilton Depression Scale (HAM-D). The Iyengar yoga classes took place over 8 weeks with 3, 60-90 minutes classes per week for a total of 20 classes. Subjects used the HAM-D, Quick Inventory of Depressive Symptoms (QIDS), Spielberger Anger Expression Scale, STAI, Cook-Medley Hostility Scale, Pittsburgh Sleep Scale and SF-36 health survey, with an emphasis on the pre and post data collected from the HAM-D. For 20 minutes, a resting electrocardiogram and blood pressure were measured along with heart rate, heart rate variability and baroreflex sensitivity. Mood was rated before and after each class. The HAM-D indicated that participant's 'happy' mood increased within the class time. Those who reached remission (65%) during the yoga intervention had greater reductions in QIDS, and a reduction in high frequency heart rate variability (HF-HRV) and the ratio of log-transformed ratio of the two bands for HF-HRV indicated by HFTOT-HRV while the group that did not enter remission had small increases. The change in HRV indicates a possible reduction in sympathetic nervous system activation as a result of the yoga, which may be beneficial in balancing and reducing stress response. The authors conclude that the emotional, psychological and biological effects of yoga are efficient as well as cost effective in reducing depression.

Mindful based cognitive therapy (MBCT) may benefit those with recurrent MDD who are currently recovered (Teasdale et al., 2000). The training program used MDD patients in remission or recovery who trained for 8 weeks which was followed up 52 weeks later. Inclusion criteria included being 18-65 years old having 2 episodes of depression, using the DSM-IV, in the last 5 years with one in the past 2 years, having a history of antidepressant use but not currently on medication, and a HRSD score of less than 10 at baseline. Patients were excluded for non-unipolar depression, substance abuse, personality

disorder, more than 4 sessions of MBCT in the past, current psychotherapy, and current practice of yoga more than twice per week. HRSD, BDI, and relapse were surveyed at baseline, upon completion of training and bimonthly in the following year. MBCT was used to engage participants in their awareness of thoughts, feelings and bodily sensations to reduce depression relapse and recurrence. Subjects completed individual orientation sessions followed by 8 weekly 2 hour sessions including awareness exercises with follow up meetings at 1, 2, 3 and 4 months. The recurrence or relapse of depression was determined in the number of weeks among patients with 2, 3 or more previous episodes of depression. The results indicated that in those with three of more previous episodes of depression MBCT almost halved the relapse/recurrence.

Summary

In non-depressed older adults, 60-77 years of age, resistance training at a high intensity or variable intensity was associated with increased mood after 24 weeks (McLafferty et al., 2004). In the elderly, increased physical activity is associated with less depression (Kritz-Silverstein et al., 2001). In men and women that are inactive, higher rates of depression are common (Augestad, Slettemoen & Flanders, 2008). Augestad et al. (2008) found that women under age 50 who were inactive or low active were at similar risk for being depressed, while men who reported a low activity level were at less risk of depression than those who were inactive.

Depression is a common illness throughout the world that increases in prevalence as well as severity when associated with disease and disability. The cause of depression may be genetic, biochemical or the result of life events and the exact mechanisms of depression remain unclear. Among depressed older adults participation in exercise is possible as a

method of treatment for depression and may have similar adherence rates as the use of antidepressant medication, however dropout rates are higher among depressed over non-depressed older adults. Promoting physical activity to adults with depression may decrease depressive symptoms as well as gaining the health benefits associated with exercise. The study will investigate the effect exercise has on depressive symptoms in older adults as the length of time one participates in physical activity increases.

Chapter III:

Methods and Procedures

Introduction

The purpose of this study was to compare the prevalence of depressive symptoms in older adults who have exercised regularly for different lengths of time. The subjects' activity levels were determined by the number of days per week they regularly took part in physical activity. This chapter describes the study population, the design of the study, procedures for data collection and finally data analyses procedures.

Description of Study Population

The study population consisted of 47 adults over 65 years of age. Subjects volunteered to take part in this study and were recruited from Bellingham, Mt. Vernon, and Anacortes, Washington. The subjects were recruited based on the length in years that they have been participating in physical activity. The types and perceived intensity of activity was recorded but the criteria determining activity level was the number of days per week the subject took part in physical activity. For placement in the exercise groups, subjects had to participate in physical activity 3 days per week or more.

All subjects were community-dwelling adults without physical conditions that would prevent them from participating in regular physical activity as determined by the Health History Form. Community-dwelling was defined as not living in assisted living or a nursing home. Group 1 was sedentary, group 2 started an exercise program within the last year, group 3 participated in exercise for greater than 1 year and less than 5 years, group 4

participated in at least 5 years but less than 10 years of regular physical activity, and group 5 participated for at least 10 years.

Design of Study

Permission to perform this study was granted by the Human Subjects Committee at Western Washington University. The study was a cross-sectional design examining 5 groups of older adults at one time. The groups were based on length of continuous participation in a physical activity, as indicated by the subject prior to enrollment in the study. Subjects completed the Center for Epidemiological Studies Depression Scale (CES-D), Physical Activity Scale for the Elderly (PASE), health history, The Positive and Negative Affect Schedule (PANAS) and the UCLA Loneliness Scale Version 3.

Data Collection Procedures

Prior to participation subjects were informed of procedures before signing an informed consent form (see Appendix A). Participants were made aware that at any time they could leave the study. Subjects completed a health history, personality survey, social network survey, depression survey, and PASE.

The Health History Form (see Appendix B) included demographic information such as age, sex, marital status, level of education and health information including comorbidities such as arthritis, heart disease and depression, and a brief exercise history. In the comorbidities section if the subjects responded 'yes' to depression, further explanation was required including when the diagnosis was made, how long the depression lasted, and past or present medications or other treatments for depression. For the exercise history subjects reported when they began a continuous habit of regular exercise at their current level. Interruptions in this exercise pattern for greater than 2 weeks were reported and a reason for

this interruption was determined. If subjects had a lapse in activity lasting longer than 4 weeks the length of continuous exercise was based from the return to physical activity from that break.

Subjects completed the UCLA Loneliness Scale Version 3 (see Appendix C), the CES-D (see Appendix D) and the PANAS (see Appendix E). The UCLA Loneliness Scale is scored from 1= never, 2= rarely, 3= sometimes and 4= always. Scores are summed and higher scores indicate more loneliness (Russell 1996). The PANAS measure has subjects report based on how they „generally' feel and is scored on a scale of 1-5, with 1 being very slightly and 5 being extremely (Watson et al., 1988). The PASE (see Appendix F) was completed to record the subjects' physical activity for the past week.

The researcher was available to answer any questions while completing the surveys, but offered no comments during completion of CES-D, as they could influence response. Upon evaluation subjects with CES-D scores of 16 or greater were notified suggesting that they consider speaking with a healthcare professional regarding increased risk of depression.

Statistical Analysis

Data analyzed was the length of participation in physical activity, score of depressive symptoms, UCLA Loneliness Scale, and Positive and Negative Affect. A repeated measures test, using one-way ANOVA, was used to determine differences between the groups. All comparisons were made at the $p \leq 0.05$ level.

Chapter IV

Results and Discussion

Introduction

The purpose of this study was to determine if length of exercise history in community-dwelling older adults affected depressive symptoms. Additionally, physical activity levels, positive and negative affect and social isolation were compared within the groups. The subject characteristics and results are presented in this chapter.

Results

The entire sample size was 47 subjects (28 male, 19 female), with a mean age of 75.7 and a range from 65- 92 years old. Participants volunteered to be a part of the study from Western Washington University's Mature Adult Training Program, Lynden Community Center, Bellingham Senior Center, Island Hospital Physical Therapy and Skagit Valley Hospital Heart Healthy Fitness. The physical characteristics of the group, including age, height, weight, and number of years participating in exercise 3 or more days per week, with mean and standard deviation, are reported in Table 1. Subjects were placed into group 1 if they did not meet the requirement of exercising 3 or more days per week, therefore, the mean years exercising was found to be 0.62 ± 1.31 which was greater than group 2. Demographics of the subjects including highest level of education, marital status, number of health conditions reported and previous diagnosis of depression for each group are reported in Table 2.

Table 1

Means (*SDs*) of Subject Characteristics

	Group 1 No Exercise	Group 2 < 1 year	Group 3 ≥ 1 year, < 5 years	Group 4 ≥ 5 years, < 10 years	Group 5 ≥ 10 years
	n = 9	n = 8	n = 10	n = 7	n = 13
Age (years)	76.67 (9.67)	73.5 (6.16)	73.9 (7.2)	75.86 (7.22)	77.54 (7.34)
Weight (kg)	86.97 (16.06)	82.27 (18.81)	81.5 (15.79)	80.26 (25.12)	68.99 (13.07)
Height (cm)	172.7 (9.42)	163.83 (13.64)	171.5 (9.75)	174.7 (11.87)	170.7 (14.29)
Years Exercising	0.62 (1.31)	0.46 (0.51)	2.35 (0.94)	6.29 (0.76)	16.62 (4.57)
Days Per Week	0.89 (1.05)	3.88 (1.13)	3.5 (0.85)	3.86 (1.46)	4.62 (0.96)

Group differences were found between all groups when comparing the CES-D ($F_{4, 47}$= 4.018, p= 0.008, η_p^2= 0.277) and are reported in Table 3 along with results from PASE, PANAS positive, PANAS negative and UCLA Loneliness Scale. Tests of between-subject's effects for each variable are reported in Appendix G.

Table 2

Descriptive Characteristics

	Group 1 No Exercise	Group 2 < 1 year	Group 3 ≥ 1 year, < 5 years	Group 4 ≥ 5 years, < 10 years	Group 5 ≥ 10 years
Education					
Some High School	0	1	0	1	0
High School Graduate	4	4	3	0	1
University	3	2	2	4	5
Professional or Graduate degree	2	1	5	2	7
Marital Status					
Married	7	6	8	6	12
Widowed	1	1	1	1	1
Divorced	0	1	0	0	0
Single	1	0	1	0	0
Health Conditions Reported					
0	1	0	1	0	1
1	2	2	1	2	2
2	2	2	3	4	5
3	2	2	3	4	5
4	1	1	0	0	4
5	0	1	0	0	0
Depression					
Previously diagnosed with depression	1	0	3	2	0
No previous depression diagnosis	8	8	7	5	13

Table 3

Mean (*SDs*) for Group Differences for CES-D, PASE, PANAS negative, PANAS positive, and UCLA Loneliness Scale

	Group 1 No Exercise	Group 2 < 1 year	Group 3 ≥ 1 year, < 5 years	Group 4 ≥ 5 years, < 10 years	Group 5 ≥ 10 years
CES-D[a]	6 (3.57)	6.88 (8.2)	11.4 (5.56)	3.71 (3.25)	3.62 (3.43)
PASE[a]	78.35 (70.96)	133.66 (45.74)	130.49 (52.72)	178 (54.64)	144.47 (62.21)
PANAS Negative[b]	13.56 (2.83)	12.88 (4.49)	14.50 (3.87)	13.71 (2.63)	13.46 (3.84)
PANAS Positive[b]	39.22 (9.04)	33.25 (9.44)	30.70 (9.12)	34.57 (6.97)	36.92 (3.23)
UCLA[b]	30.78 (6.63)	34.63 (10.65)	37.60 (7.17)	32.29 (4.54)	32.62 (6.85)

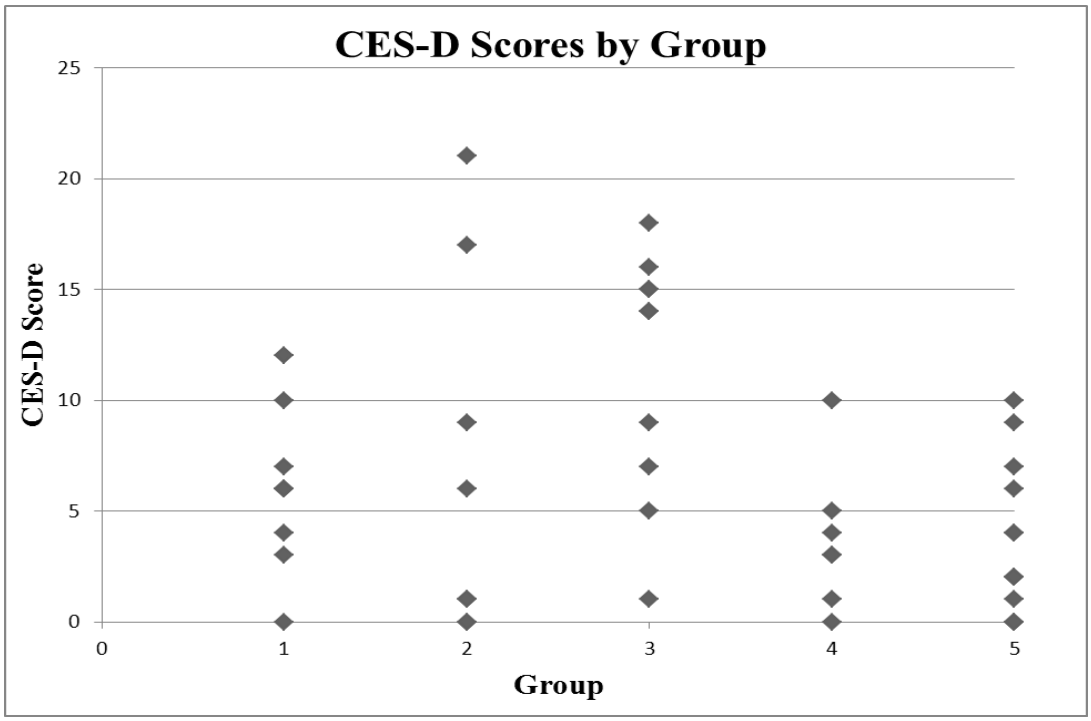
[a] significant group differences at $p \leq 0.05$

[b] no significant group differences at $p \geq 0.05$

In the pairwise comparisons, those who participated in the greatest amount of exercise, greater than 10 years, had the lowest scores on the CES-D. That trend was also evident in those who had exercised 5-10 years. Significant differences are seen in the CES-D

groups between group 1 and group 3 ($p = 0.024$), between group 3 and group 4 ($p = 0.003$), and between group 3 and group 5 ($p = 0.001$). Although not statistically significant to the $p \leq 0.05$ level, a trend toward significance was seen between group 2 and group 3 ($p = 0.064$). The mean CES-D score for those in group 3- greater than 1 year, less than 5 years was 11.40 ± 5.56, which was, unexpectedly, found to be the highest mean score of the groups. CES-D scores were also compared between sexes, however, no significant difference was found between sex. The mean CES-D score for the entire subject population was 6.3, with the females mean being 7.89 ± 6.86 and males being 5.21 ± 4.44. In Graph 1 the CES-D scores for members of each group are reported to graphically show the spread of scores. This graph shows that group 2 and group 3 had subjects with scores that were higher than other groups causing the large standard deviations within those groups.

Graph 1



PASE ($F_{4, 47}$= 3.113, p= 0.025, η_p^2= 0.229) scores showed statistically significant differences between groups. The pairwise comparisons for PASE reveal differences between group 1 and group 4 (p = 0.002) and group 1 and group 5 (p = 0.013), where group 1 had lower levels of physical activity than groups 4 and 5. The differences between group 1 and group 2 (p = 0.059), and group 1 and group 3 (p = 0.060) should be noted and further discussed. These results showed that those with no exercise history had significantly lower self-reported physical activity than those who did participate in regular physical activity. The mean PASE score was 131.9: females mean score was 148.4 while males mean score was 120.8.

PANAS negative ($F_{4, 47}$= 0.237, p= 0.916, η_p^2= 0.022) scores were not statistically significant between any groups. The mean score for all subjects was 13.64. The PANAS positive ($F_{4, 47}$= 1.802, p= 0.146, η_p^2= 0.146) scores were not statistically significant between any groups. The mean score for all subjects was 35.06. UCLA Loneliness Scale ($F_{4, 47}$= 1.212, p= .320, η_p^2= .103) scores were not statistically significant between any groups. The mean score for all subjects was 33.62.

Discussion

The subjects with the longest history of exercise were found to have the lowest CES-D scores. The main hypothesis of the study "that as the length of exercise history increased, the scores on the CES-D would decrease" was rejected. The differences between group 1, which did exercise, and those who did not were not found to be significantly different. As well, group 3 had the highest scores. The hypothesis "that subjects who participated in over

10 years of physical activity would exhibit the lowest score on the CES-D" was confirmed. It was also found that those who do not participate in physical activity did not have the highest levels of depressive symptoms, as expected. The secondary hypotheses "that there would be no difference in PANAS scores or UCLA Loneliness Scores based on length of exercise history were confirmed.

The main area of interest for this study was to determine if long-term participation in physical activity is related to depressive symptoms in older adults. As the literature review in chapter two has shown, exercise can decrease depressive symptoms. The results support that long-term exercisers in this cross-sectional study had lower depressive symptoms when they had been exercising for more than 5 years. The results found in this study are similar to those found by Harris, Cronkite and Moos (2006) in which adults aged 18 and older, who took part in regular exercise, for more than 10 years had lower depression scores. However, the current study found that after 5 years of participation in exercise the score of depressive symptoms did not further decline.

The CES-D scores found in the current study ranged from 0-21 with a mean score of 6.3. In previous research of healthy community-dwelling older adults a range of scores from 4-16 with mean scores from 12-13 has been found (Cress, Buchner, Questad, Esselman, deLateur, & Schwartz, 1999). Similar scores have been found in community-dwelling older adults who took part in a study as the control group with a mean score of 13.8 (Clark et al., 1997). In the current study the mean CES-D score was lower than those of similar populations indicating that the participants in this study had low depressive symptoms regardless of exercise history. Additionally, in the current study, group 2 and group 3 were found to have large standard deviations. This was the result of a larger range of scores within

these groups with all four subjects that scored over 16 on the CES-D being in groups 2 and 3, increasing the mean score for the group as well as the standard deviation.

The dose of physical activity in which older adults participate in can affect the outcomes they receive from exercise. Subjects in this study were categorized as not exercising if they exercised fewer than 3 days per week, which is the recommended level of exercise for health benefits in older adults, however exercise 2 days per week has been found to be sufficient in increasing the mood of older adults (Matsuoka et al., 2005). Additionally, it is reported that exercise intensity and not exercise dose had the biggest effect on depressive symptoms (Teychenne et al., 2008). By categorizing those who participated in two days per week of physical activity in the no exercise group it may have affected the results of the study. These individuals may have been receiving the benefits of physical activity concerning depressive symptoms, which could have changed the results for the group.

Levels of physical activity as reported with PASE were found to be greater among the exercise groups when compared with the non-exercising group. Subjects reported all physical activity, including exercise and activity related to leisure, household chores, work and volunteering. Significant differences were seen among those with the longest exercise history (greater than 5 years) and differences nearing significance were seen among those in groups 2 and 3. These results were expected, as those who do not participate in physical activity were expected to report lower activity levels over the course of the week. This finding additionally points to the honesty of the participants' responses.

In the PASE Administration and Scoring Instruction Manual (New England Research Institutes, Inc, 1991), norms for PASE mean scores are provided. These scores are divided for gender and age groups. For all age groups, the norms for males are higher than those for

women. In the current study, the mean PASE score for women was 148.4. Males had a mean score of 120.8. The mean score, reported in the manual, for subjects aged 65-100 was 102.9 with men aged 65-69 having the highest mean score at 144.3. Women in this age range having a mean score of 112.7. The score for females in this study was greater than the mean score reported for men or women. The high mean score for women in this study may be due, in part, to group 1, which was the lowest physical activity group, having 2 female subjects and 7 male subjects. The overall mean score in the current study was 131.9, which is greater than the reported mean score for PASE of 102.9. This indicates that participants in this study were on average more active than the score reported by the PASE manual.

Subjects' positive and negative affect revealed no significant differences between groups. High positive affect in older adults is correlated with lower depressive levels while high negative affect has been associated with decreased physical quality of life, mental quality of life and higher depressive symptoms (Hong et al., 2004; Hu & Gruber, 2008). This study resulted in no difference between groups for either positive or negative affect, which may be a result of participants being healthy and physically able to exercise. Mather and Knight (2005) studied older adults with a mean age of 72.72 and found that the mean positive affect was 36.08 and mean negative affect was 11.50. These results were similar to the mean PANAS scores in the current study of 35.06 and 13.64 respectively, as well as prior findings by Charles, Mather and Cartensen (2003). In all three studies the subjects were healthy older adults, however, in the previous research it was not reported if subjects were community-dwelling.

Participants took the UCLA Loneliness Scale to report satisfaction with social relationships. This study found no significant difference between the groups in their

satisfaction with social relationships. Loneliness in older adults can have an impact on well being especially in the area of depression, with lonelier men reporting higher depressive symptoms (Alpass & Neville, 2003). Alpass and Neville report that social isolation may influence depression in older adult men. In this study the subjects were recruited from social settings including community centers so it was expected that the UCLA Loneliness Scale scores would not be significantly different as all subjects were socially active. The original UCLA Loneliness Scale reported a mean score for healthy young adults of 38.9 while the UCLA Loneliness Scale Version 3 reported a mean score of 31.51 for adults over 65 years of age (Russell, 1996; Russell, Paplau, & Ferguson, 1978). These mean scores are similar to the mean score reported for the current study of 33.62.

Group 3 stands out from the other groups when looking for trends within these results. The mean CES-D score for all groups was low, however, group 3 was higher than the other groups in this study. Additionally, there is a trend for group 3 to have higher negative affect, lower positive affect, higher UCLA Loneliness Scores, and lower PASE scores than the other exercise groups, as well as more subjects with a previous diagnosis of depression than other groups. These trends are probably a result of the small subject number in this study but may have impacted the CES-D score of this group.

Chapter V

Summary, Conclusions, and Recommendations

Summary

Depression is a serious illness seen throughout the world. The causes of depression are not fully understood, however it is widely accepted that exercise can improve depressive symptoms. Older adults are at an increased risk from depression due to the link between depression and decreased physical functioning, disease and disability. Studies show that exercise interventions can be as effective in reducing depressive symptoms as pharmacological treatments and are still effective in reducing depressive symptoms 12 and 60 months after the intervention (Babyak et al., 2000; Blumenthal et al., 1999; Motl et al., 2005). Being physically active has also been associated with decreased depressive symptoms when studying those with a history of physical activity lasting 10 or more years (Harris, Cronkite & Moos, 2006)

A total of 47 subjects recruited from western Washington took part in the study by completing a health history, CES-D, PASE, UCLA Loneliness Scale and PANAS. Subjects were 65 years and older and had no limitations that would prevent them from participating in physical activity. The purpose of the study was to determine if the length of exercise history had a relationship with depressive symptoms.

Demographic information was reported on the health history as well as subject information about health conditions including previous diagnosis of depression. The UCLA Loneliness Scale and PANAS were used to report information about social interactions and subjects' affect to determine if those factors differed between groups and were related to the group differences in depressive scores in additions to physical activity level.

Conclusions

The results of this study showed that length of exercise history beyond 5 years influenced depressive symptoms in community-dwelling older adults. This finding was expected as previous research has shown that exercise history over 10 years results in lower depressive symptoms. It was unexpected that those with less than one year of exercise history did not have significantly different results than those with no exercise history and that subjects with between 1 and 5 years of exercise history had the highest scores on the CES-D. No differences were found between groups for PANAS and the UCLA Loneliness Scale.

Recommendations

1. Complete a longitudinal study to follow subjects as they age and participate in an exercise program. This will allow for less variability between subjects and establish a baseline for depressive symptoms prior to starting an exercise program.
2. Repeat the current study with participants in the exercise groups recruited from one location and completing the same workouts throughout the week reducing variability in exercise intensity, duration, and days per week.
3. Complete a training study to determine the effects of exercise on depressive symptoms and monitor subject's intensity as well as controlling for type of exercise and continue to follow subjects in a longitudinal study.
4. Monitor the exercise intensity of the subjects, rather than grouping based on days per week, as those who exercised at a higher intensity 2 days per week may still receive the benefits of exercise in regards to lowering depressive symptoms. The intensity could be monitored in a supervised exercise

References

Alpass, F. M., & Neville, S. (2003). Loneliness, health and depression in older males. *Aging and Mental Health, 7,* 212-216. doi: 10.1080/1360786031000101193

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Washington (DC); 1994.

Augestad, L., Slettemoen, R., & Flanders, W. (2008). Physical activity and depressive symptoms among Norwegian adults aged 20-50. *Public Health Nursing, 25*, 536-545. doi: 10.1111/j.1525-1446.2008.00740.x

Babyak, M., Blumenthal, J. A., Herman, S., Khatri, P., Doraiswamy, M., Moore, K.,... Krishnan, K. R. (2000). Exercise treatment for major depression: maintenance of therapeutic benefit at 10 months. *Psychosomatic Medicine, 62*, 633-638.

Badger, T., Segrin, C., Meek, P., Lopez, A., & Bonham, E. (2005). Profiles of women with breast cancer: who responds to a telephone interpersonal counseling intervention? *Journal of Psychosocial Oncology, 23*, 79-100.

Bebbington, P., Dunn, G., Jenkins, R., Lewis, G., Brugha, T., Farrell, M., & Meltzer, H. (1998). The influence of age and sex on the prevalence of depressive conditions: report from the National Survey of Psychiatric Morbidity. *Psychological Medicine, 28*, 9-19. doi:10.1017/S00332917 97006077

Blumenthal, J., Babyak, M., Moore, K., Craighead, E., Herman, S., Khatri, P., & Krishnan, R. (1999). Effects of exercise training on older patients with major depression. *Archives of Internal Medicine, 159*, 2349-2356. doi:10.1001/archinte.159.19.2349

Brown, L., & Schinka, J. (2005). Development and initial validation of a 15-item informant version of the Geriatric Depression Scale. *International Journal of Geriatric Psychiatry, 20*, 911-918. doi:10.1002/gps.1375

Brown, R., & Gerbarg, P. (2005). Sudarshan Kriya yogic breathing in the treatment of stress, anxiety, and depression: Part I- neurophysiologic model. *The Journal of Alternative and Complementary Medicine, 11*, 189-201. doi:10.1089/acm.2005.11.189

Chapman, D.P., & Perry, G. S. (2008). Depression as a major component of public health for older adults. *Preventing Chronic Disease, 5*. Retrieved Oct, 26, 2008 from http://www.cdc.gov/ pcd/issues/2008/jan/07_0150.htm.

Charles, S., Mather, M., & Cartensen, L. (2003). Aging and emotional memory: the forgettable nature of negative images for older adults. *Journal of Experimental Psychology, 132,* 310-324. doi:10.1037/0096-3445.132.2.310

Clark, F., Azen, S., Zemke, R., Jackson, J., Carlson, M., Mandel, D.,… Lipson, L. (1997). Occupational Therapy for independent-living older adults: a randomized controlled trial. *Journal of the American Medical Association, 278,* 1321-1326.

Crawford, J., & Henry, J. (2004). The Positive and Negative Affect Schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology,* 43, 245-265. doi:10.1348/0144665031752934

Cress, E., Buchner, D., Questad, K., Esselman, P., deLateur, B., & Schwartz, R. (1999). Exercise: effects on physical functional performance in independent older adults. *Journal of Gerontology: MEDICAL SCIENCES, 54A,* M242-M248.

Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and type D personality. *Psychosomatic Medicine, 67*, 89-97. doi:10.1097/01.psy.0000149256.81953.49

Department of Human Services: The Victorian population health survey. (2004). Victoria, Department of Human Services.

Dinger, M., Oman, F., Taylor, E., Vesely, S. & Able, J. (2004). Stability and convergent validity of the Physical Activity Scale for the Elderly (PASE). *Journal of Sports Medicine and Physical Fitness*, *44*, 186-192.

Dunn, A., Trivedi, M., Kampert, J., Clark, C., & Chambliss, H. (2005). Exercise for depression: efficacy and dose response. *American Journal of Preventative Medicine, 28*, 1-8. doi:10.10 16/j.amepre.2004.09.003

Everard, K., Lach, H., Fisher, E., & Baum, M. (2000). Relationship of activity and social support to the functional health of older adults. *Journal of Gerontology, 55B*, S208-S212.

Fisher, L., Mohr, D., Skaff, M., Masharani, U., Mullan, J., Glasgow, R.,… Laurencin, G. (2007). Clinical depression versus distress among patients with type 2 diabetes. *Diabetes Care, 30*, 542-548. doi:10.2337/dc06-1614

France, C., Lysaker, P., & Robinson, R. (2007). The "chemical imbalance" explanation for depression: origins, lay endorsement, and clinical implications. *Professional Psychology: Research and Practice, 38*, 411-420. doi:10.1037/0735-7028.38.4.411

Gallegos-Carrillo, K., Garcia-Pena, C., Mudgal, J., Romero, X., Duran-Arenas, L., & Salmeron, J. (2009). Role of depressive symptoms and comorbid chronic disease on

health-related quality of life among community-dwelling older adults. *Journal of Psychosomatic Research, 66*, 127-135. doi:10.1016/j.jpsychores.2008.07.2007

Gallegos-Carrillo, K., Mudgal, J., Sanchez-Garcia, S., Wagner, F., Gallo, J., Salmeron, J., & Garcia- Pena, C. (2009). Social networks and health-related quality of life: a population based study among older adults. *Salud Publica de Mexico, 51*, 6-13. doi:10.1590/S0036-363420090001 00004

Goodwin, Renee. (2003). Association between physical activity and mental disorders among adults in the United States. *Preventative Medicine, 36*, 968-703. doi:10.1016/S0091435(03) 00042-2

Harris, A., Cronkite, R., & Moos, R. (2006). Physical activity, exercise coping, and depression in a 10-year cohort study of depressed patients. *Journal of Affective Disorders, 93*, 79-85. doi: 10.1016/j.jad.2006.02.013

Heo, M., Murphy, C., Fontaine, K., Bruce, M. and Alexopoulos, G. (2008). Population projection of US adults with lifetime experience of depressive disorder by age and sex from year 2005 to 2050. *International Journal of Geriatric Psychiatry, 23*, 1266-1270. doi:10.1002/gps.2061

Hong, T., Zarit, A., & Malmberg, B. (2004). The role of health congruence in functional status and depression. *The Journal of Gerontology Series B: Psychological Sciences and Social Sciences, 5*, 151-157.

Hu, J., & Gruber, K. (2008). Positive and negative affect and health functioning indicators among older adults with chronic illnesses. *Issues in Mental Health Nursing, 29*, 895-911. doi:10.1080/01612840802182938

Huang, T., & Lee. C. (2007). T-helper 1/ T-helper 2 cytokine imbalance and clinical

phenotypes of acute-phase major depression. *Psychiatry and Clinical Neurosciences, 61*, 415-420. doi:10.1111/j.1440-1819.2007.01686.x

Janakiramaiah, N., Gangadhar, B. N., Murthy, P. J., Harish, M. G., Subbakrishna, D. K., & Vedamurthachar, A. (2000). Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: a randomized comparison with electroconvulsive therapy (ECT) and imipramine. *Journal of Affective Disorders, 57*, 255-259. doi:10.1016/S0165-0327(99) 00079-8

Johansson, M., & Hassmén, P. (2008). Acute psychological responses to Qigong exercise of varying durations. *The American Journal of Chinese Medicine, 36*, 449-458. doi:10.1142/ S0192415X08005898

Kritz-Silverstein, D., Barrett-Connor, E., & Corbeau, C. (2001). Cross- sectional and prospective study of exercise and depressed mood in the elderly: the Rancho Bernardo study. *American Journal of Epidemiology,153,* 596-603. doi:10.1093/aje/153.6.596

Kunik, M., Roundy, K., Veazey, C., Souchek, J., Richardson, P., Wray, N., & Stanley, M. (2005). Surprisingly high prevalence of anxiety and depression in chronic breathing disorders. *Chest Journal, 127*, 1205-1211. doi:10.1378/chest.127.4.1205

Lakey, S. L., Gray, S. L., Ciechanowski, P, Schwartz, S., & LoGerfo, J. (2008). Antidepressant use in non-major depression: secondary analysis of a program to encourage active, rewarding lives for seniors (PEARLS), a randomized controlled trial in older adults from 2000-2003. *The American Journal of Geriatric Pharmacotherapy, 6*, 12-20. doi:10.1016.j.amjopharm. 2008.03.004

Lavretsky, H., Zheng, L., Weiner, M., Mungas, D., Reed, B., Kramer, J. H.,… Mack, W. J. (2008). The MRI brain correlates of depressed mood, anhedonia, apathy, and anergia in older adults with and without cognitive impairment or dementia. *International Journal of Geriatric Psychiatry, 23,* 1040-1050. doi:10.1002/gps.2030

Lin, E., Katon, W., Von Korff, M., Tang, L., Williams, J., Kroenke, K.,… Unutzer, J. (2003). Effect of depression care on pain and functional outcomes among older adults with arthritis. *The Journal of the American Medical Association, 290*, 2428-2434. doi:10.1001/jama.290.18. 2428

Luanaigh, C., & Lawlor, B. (2008). Loneliness and the health of older people. *International Journal of Geriatric Psychiatry,* 23, 1213-1221. doi:10.1002/gps.2054

Mather, M., & Knight, M. (2005). Goal-directed memory: the role of cognitive control in older adults' emotional memory. *Psychology and Aging, 20,* 554-570. doi:10.1037/0882-7974.20.4.554

Matsuoka, O., Kabitsis, C., Harahousou,Y., & Trigonis, I. (2005). Mood alterations following an indoor and outdoor exercise program in healthy elderly women. *Perceptual and Motor Skills, 100*, 707-715. doi:10.2466/PMS.100.3.707-715

McLafferty, C. L., Wetzstein, C. J., & Hunter, G. R. (2004). Resistance training in associated with improved mood in healthy older adults. *Perceptual and Motor Skills, 98*, 947-957. doi:10.246 6/PMS.98.3.947-957

McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy, 38*, 23-38. doi:10.1016/j.beth.200 6.03.003

Mojtabai, R., & Olfson, M. (2004). Major depression in community-dwelling middle-aged and older adults: prevalence and 2- and 4-year follow-up symptoms. *Psychological Medicine, 34*, 623-634. doi:10.1017/S0033291703001764

Motl, R., Konopack, J., McAuley, E., Elavsky, S., Jerome, G., & Marquez, D. (2005). Depressive symptoms among older adults: long term reduction after a physical activity intervention. *Journal of Behavioral Medicine, 28*, 385-394. doi:10.1007/s10865-005-9005-8

Murphy, J. M., Burke, J. D., Monson, R. R., Horton, N. J., Laird, N. M., Lesage, A., Sobol, A. M., & Leighton, A. H. (2008). Mortality associated with depression. *Social Psychiatry and Psychiatric Epidemiology, 43*, 594-601. doi:10.1007/s00127-008-0323-3

Nabkasorn, C., Miyai, N., Sootmongkol, A., Junprasert, S., Yamamoto, H., Arita, M., & Miyashita, K. (2005). Effects of physical exercise on depression, nueroendocrine stress hormones and physiological fitness in adolescent females with depressive symptoms. *European Journal of Public Health, 16*, 179-184. doi:10.1093/eurpub/cki159

Nelson, M. E., Rejeski, J. W., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C.,… & Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults. *Circulation, 116,* 1094-1105. doi:10.1161/CIRCULATIONAHA.107.185650

Netz, Y., & Lidor. R. (2003). Mood alterations in mindful versus aerobic exercise modes. *Journal of Psychology,137*, 405-419.

Ng, T., Niti, M., Tan, W., Cao, Z., Ong, K., & Eng, P. (2007). Depressive symptoms and

chronic obstructive pulmonary disease: effect on mortality, hospital readmission, symptom burden, functional status, and quality of life. *Archives of Internal Medicine, 167,* 60-67. doi:10.1001/archinte.167.1.60

Nguyen, H. Q., Koepsell, T., Unutzer, J., Larson, E., & LoGerfo, J. P. (2008). Depression and use of health plan-sponsored physical activity program by older adults. *American Journal of Preventative Medicine, 35*, 111-117. doi:10.1016/j.amepre.2008.04.014

PASE Physical Activity Scale for the Elderly Administration and Scoring Instruction Manual. (1991). Watertown, MA. New England Research Institutes, Inc.

Pavot, W., & Diener, E. (1993). Review of satisfaction with life scale. *Psychological Assessment, 5,* 164-172. doi:10.1037/1040-3590.5.2.164

Penninx, B. W., Guralnik, J. M., Ferrucci, L., Simonsick, E. M., Deeg, D. J., & Wallace, R. B. (1998). Depressive symptoms and physical decline in community-dwelling older persons. *The Journal of the American Medical Association, 279*, 1720-1726. doi:10.1001/jama.279. 21.1720

Pratt, L. & Brody, D. (2008). "Depression in the United State household population, 2005-2006. National Center for Health Statistics. Data Brief No. 7.

Rejeski, W. J., & Mihalko, S. L. (2001). Physical activity and quality of life in older adults. *Journals of Gerontology: Series A, 56A*(11), 23-35.

Russell, D. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity and factor structure. *Journal of Personality Assessment, 66,* 20-40. doi:10.1207/s15327752jpa6601_2

Russell, D., Peplau, L.A., & Cutrona, M. (1980). The revised UCLA Loneliness scale: Concurrent and discriminant validity evidence. *Journal of Personality and*

Social Psychology, 39, 472-480. doi:10.1037/0022-3514.39.3.472

Russell, D., Peplau, L.A., & Ferguson, M. (1978). Developing a measure of loneliness. *Journal of Personality Assessment, 42,* 290-294.

Segal, D. L., Coolidge, F. L., Cahill, B. S., & O'Riley, A. A. (2008). Psychometric properties of the Beck Depression Inventory-II (BDI-II) among community-dwelling older adults. *Behavior Modification, 32,* 3-20. doi:10.1177/0145445507303833

Sims, J., Hill, K., Davidson, S., Gunn, J., & Huang, N. (2006). Exploring the feasibility of a community-based strength training program for older people with depressive symptoms and its impact on depressive symptoms. *BMC Geriatrics,* 6. doi:10.1186/1471-2318-6-18

Singh, A. S., Chin A Paw, M. J., Bosscher, R. J., & Van Mechelen, W. (2006). Cross-sectional relationship between physical fitness components and functional performance in older persons living in long-term care facilities. *BMC Geriatrics, 6*. doi:10.1186/1471-2318-6-4

Shapiro, D., Cook, I. A., Davydov, D. M., Ottaviani, C., Leuchter, A. F., & Abrams, M. (2007). Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcomes. *eCAM.* Published February 28, 2007 at doi:10.1093/ecam/nel114.

Soldz, S. & Vaillant, G. E. (1999). The Big Five personality traits and the life course: a 45-year longitudinal study. *Journal of Research in Personality*, 33, 208-232. doi:10.1006/jrpe.19 99.2243

Stewart, M., Craig, D., MacPherson, K., & Alexander, S. (2001). Promoting positive affect and diminishing loneliness of widowed seniors through a support intervention. *Public Health Nursing, 18*, 54-63.

Strawbridge, W. J., Deleger, S., Roberts, R. E., & Kaplan, G. A. (2002). Physical activity reduces the risk of subsequent depression for older adults. *American Journal of Epidemiology, 156,* 328-334. doi:10.1093/aje/kwf047

Sylvia, L. G., Kopeski, L. M., Mulrooney, C., Reid, J., Jacob, K., & Neuhaus, E. C. (2009). Does exercise impact mood? Exercise patterns of patients in a psychiatric partial hospital program. *Journal of Psychiatric Practice, 15,* 70-78. doi:10.1097/01.pra.0000344923.81898.53

Teasdale, J. D., Segal, Z. V., Williams, J. M., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A.(2000). Prevention of relapse/recurrence in major depression by mindful-based cognitive therapy. *Journal of Consulting and Clinical Psychology, 68,* 615-623. doi:10.1037/0022-006X.68.4.615

Teychenne, M., Ball, K., & Salmon, J. (2008). Associations between physical activity and depressive symptoms in women. *International Journal of Behavioral Nutrition and Physical Activity,* 5, 27-39. doi: 10.1186/1479-5868-5-27

Toker, S., Shirom, A., & Melamed, S. (2008). Depression and the metabolic syndrome: gender-dependent associations. *Depression and Anxiety, 25*, 661-669. doi:10.1002/da.20379

Trouillet, R., & Gana, K. (2008). Age differences in temperament, character and depressive moos: a cross sectional study. *Clinical Psychology and Psychotherapy, 15*, 266-275. doi:10.1002/epp. 580

Watson, D., & Clark, L. (1992). On traits and temperament: general and specific factors of emotional experience and their relation to the Five-Factor model. *Journal of Personality, 60,* 441-476.

Watson, D., Clark, L., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scale. *Journal of Personality and Social Psychology, 54*, 1063-1070.

Washburn, R., & Ficker, J. (1999). Physical Activity Scale for the Elderly (PASE): the relationship with activity measured by a portable accelerometer. *Journal of Sports Medicine and Physical Fitness, 39*, 336-340.

Williams, C. L., & Tappen, R. M. (2008). Exercise training for depressed older adults with Alzheimer's. *Aging and Mental Health* 12, 72-80. doi:10.1080/13607860701529932

Woolery, A., Myers, H., Sternlieb, B., & Zeltzer, L. (2004). A yoga intervention for young adults with elevated symptoms of depression. *Alternative Therapies, 10,* 60-63.

Usten, T. B., Ayuso-Mateos, J. L., Chatterji, S., Mathers, C. & Murray, C. J. (2004). Global burden of depressive disorders in the year 2000. *The British Journal of Psychiatry, 184,* 386-392. doi:10.1192/bjp.184.5.386

Appendix A

Informed Consent Form

Informed Consent Form
Western Washington University

Purpose of the Study:
The study will be conducted to determine if the length of time the participant has participated in physical activity effects the depressive symptoms the participant experiences as well as reporting additional measures such as personality, measures of social support and health history. It has been previously shown that exercise is effective in reducing depressive symptoms, and this study will lend support to prescribing exercise as a preventative measure for depression in older adults.

Procedures of Study:
If you agree to participate, you will complete five questionnaire including health history, exercise history, personality, social support and depressive symptoms.

Discomforts and Risks:
There are no anticipated risks to the subject, however at any time the participant may request not to answer a question.

Benefits to Participants:
The participants will not experience any direct benefits as a result of participating in this study.

Confidentiality:
Any answers to questions or data collected will remain confidential with regard to identity. At the start of the study each participant will be given a subject ID number which will be used on all forms. Names or identifying information will not appear in data.

Participation and Withdrawal:
Participation in this study is voluntary. At any time subjects may choose to withdrawal or discontinue participation, including denying answers to specific items or questions.

Your willingness to participate in this study is greatly appreciated. Any questions or comments on the study procedures can be directed to me personally at (360) 588-4659 or kmbroder@gmail.com.
If you have any questions about your participation or your rights as a research participant, you can contact Geri Walker, WWU Human Protections Administrator, (360) 650-3220, geri.walker@wwu.edu.

I have read and understand the procedures for the study described above. I am at least 65 years of age. I understand that I may withdrawal from this study at any time.

Printed Name of Participant _____ Date _____

Signature of Participant _____
A copy of this consent form will be provided to each subject.

Appendix B

Health History Form

Subject Number _____

Health History Form

Name _____
Date of Birth _____ Sex ____ Age_____
Height _____ Weight_____
Highest Level of Education_____
Marital Status_____
Ethnicity _____

Please check if you have any of the following health conditions and indicate when

Health Conditions	
Allergies	
Anxiety or emotional disorder	
Arthritis or joint pain/stiffness	
Asthma	
Back or neck disorder	
Breathing disorder (bronchitis or emphysema)	
Depression	
Diabetes	
Heart or circulatory (artery disease, high blood pressure, angina)	
Migraines/chronic headaches	
Stomach or bowel disorder	
Other	

If you answered „no' to Depression go on to the next page

Are you currently undergoing any treatment for depression (i.e. Medication, therapy)?
_____
_____
_____

Have you ever undergone any treatment for your depression?

When was your first diagnosis of depression?
_____

Personal History

In the past 2 weeks have any major life events occurred? (Example- Death of a loved one)

_____

_____

_____

In the past 2 weeks have you been ill? _____

Exercise History

Do you currently exercise? Yes____ No____

If you answered no- please note if within the last 12 months you were taking part in any regular exercise program. Yes_____ No _____

If yes continue on, if no please continue to the next page.

How many days per week do you regularly exercise?

_____

_____

What type of exercise or exercises do you participate in?

_____

_____

_____

How long have you been exercising at this level?

_____

_____

Have you ever taken a break from your regular exercise program that lasted greater than 2 weeks? Please indicate when and why

Appendix C

UCLA Loneliness Scale (Version 3)

UCLA Loneliness Scale (Version 3)

Instructions: The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by writing a number in the space provided. Here is an example:

How often do you feel happy?

If you never felt happy, you would respond "never"; if you always feel happy, you would respond "always."

NEVER	RARELY	SOMETIMES	ALWAYS
1	2	3	4

____ 1. How often do you feel that you are "in tune" with the people around you?
____ 2. How often do you feel that you lack companionship?
____ 3. How often do you feel that there is no one you can turn to?
____ 4. How often do you feel alone?
____ 5. How often do you feel part of a group of friends?
____ 6. How often do you feel that you have a lot in common with the people around you?
____ 7. How often do you feel that you are no longer close to anyone?
____ 8. How often do you feel that your interests and ideas are not shared by those around you?
____ 9. How often do you feel outgoing and friendly?
____ 10. How often do you feel close to people?
____ 11. How often do you feel left out?
____ 12. How often do you feel that your relationships with others are not meaningful?
____ 13. How often do you feel that no one really knows you well?
____ 14. How often do you feel isolated from others?
____ 15. How often do you feel you can find companionship when you want it?
____ 16. How often do you feel that there are people who really understand you?
____ 17. How often do you feel shy?
____ 18. How often do you feel that people are around you but not with you?
____ 19. How often do you feel that there are people you can talk to?
____ 20. How often do you feel that there are people you can turn to?

Items 1, 5, 6, 9, 10, 15, 16, 19, and 20 should be reversed. Higher scores indicate greater degrees of loneliness.

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. Journal of Personality Assessment, 66, 20-40.

Appendix D

Center for Epidemiological Studies Depression Scale

Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week.

	During the Past Week			
	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	☐	☐	☐	☐
2. I did not feel like eating; my appetite was poor.	☐	☐	☐	☐
3. I felt that I could not shake off the blues even with help from my family or friends.	☐	☐	☐	☐
4. I felt I was just as good as other people.	☐	☐	☐	☐
5. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
6. I felt depressed.	☐	☐	☐	☐
7. I felt that everything I did was an effort.	☐	☐	☐	☐
8. I felt hopeful about the future.	☐	☐	☐	☐
9. I thought my life had been a failure.	☐	☐	☐	☐
10. I felt fearful.	☐	☐	☐	☐
11. My sleep was restless.	☐	☐	☐	☐
12. I was happy.	☐	☐	☐	☐
13. I talked less than usual.	☐	☐	☐	☐
14. I felt lonely.	☐	☐	☐	☐
15. People were unfriendly.	☐	☐	☐	☐
16. I enjoyed life.	☐	☐	☐	☐
17. I had crying spells.	☐	☐	☐	☐
18. I felt sad.	☐	☐	☐	☐
19. I felt that people dislike me.	☐	☐	☐	☐
20. I could not get "going."	☐	☐	☐	☐

SCORING: zero for answers in the first column, 1 for answers in the second column, 2 for answers in the third column, 3 for answers in the fourth column. The scoring of positive items is reversed. Possible range of scores is zero to 60, with the higher scores indicating the presence of more symptomatology.

Appendix E

Positive and Negative Affect Schedule

Subject Number _____

This scale consists of a number or words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word that indicates to what extent you have felt this way during the past week.

1	2	3	4	5
Very slightly or not at all	a little	moderately	quite a bit	extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Appendix F

Physical Activity Scale for the Elderly

PHYSICAL ACTIVITY SCALE FOR THE ELDERLY

(P A S E)

New England
Research Institutes, Inc.

9 Galen Street
Watertown, MA 02472
(617) 923-7747

INSTRUCTIONS:

Please complete this questionnaire by either circling the correct response or filling in the blank. Here is an example:

During the past 7 days, how often have you seen the sun?

[0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS)

Answer all items as accurately as possible. All information is strictly confidential.

LEISURE TIME ACTIVITY

1. Over the past 7 days, how often did you participate in sitting activities such as reading, watching TV or doing handcrafts?

[0.] NEVER	[1.] SELDOM (1-2 DAYS)	[2.] SOMETIMES (3-4 DAYS)	[3.] OFTEN (5-7 DAYS)
↓	↓	↓	↓
GO TO Q.#2			

1a. What were these activities?

_____

1b. On average, how many hours per day did you engage in these sitting activities?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

2. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog, etc.?

[0.] NEVER	[1.] SELDOM (1-2 DAYS)	[2.] SOMETIMES (3-4 DAYS)	[3.] OFTEN (5-7 DAYS)
↓	↓	↓	↓
GO TO Q.#3			

2a. On average, how many hours per day did you spend walking?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

3. Over the past 7 days, how often did you engage in light sport or recreational activities such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

[0.] NEVER	[1.] SELDOM (1-2 DAYS)	[2.] SOMETIMES (3-4 DAYS)	[3.] OFTEN (5-7 DAYS)
↓	↓	↓	↓
GO TO Q.#4			

3a. What were these activities?

_____

3b. On average, how many hours per day did you engage in these light sport or recreational activities?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

4. Over the past 7 days, how often did you engage in moderate sport and recreational activities such as doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

[0.] NEVER	[1.] SELDOM (1-2 DAYS)	[2.] SOMETIMES (3-4 DAYS)	[3.] OFTEN (5-7 DAYS)
↓	↓	↓	↓
GO TO Q.#5			

4a. What were these activities?

_____

4b. On average, how many hours per day did you engage in these moderate sport and recreational activities?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

5. Over the past 7 days, how often did you engage in strenuous sport and recreational activities such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross-country) or other similar activities?

[0.] NEVER → GO TO Q.#6

[1.] SELDOM (1-2 DAYS) →

[2.] SOMETIMES (3-4 DAYS) →

[3.] OFTEN (5-7 DAYS) →

5a. What were these activities?

_____

5b. On average, how many hours per day did you engage in these strenuous sport and recreational activities?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

6. Over the past 7 days, how often did you do any exercises specifically to increase muscle strength and endurance, such as lifting weights or pushups, etc.?

[0.] NEVER → GO TO Q.#7

[1.] SELDOM (1-2 DAYS) →

[2.] SOMETIMES (3-4 DAYS) →

[3.] OFTEN (5-7 DAYS) →

6a. What were these activities?

_____

6b. On average, how many hours per day did you engage in exercises to increase muscle strength and endurance?

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

HOUSEHOLD ACTIVITY

7. During the past 7 days, have you done any light housework, such as dusting or washing dishes?

   [1.] NO [2.] YES

8. During the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood?

   [1.] NO [2.] YES

9. During the past 7 days, did you engage in any of the following activities?

   Please answer YES or NO for each item.

		NO	YES
a.	Home repairs like painting, wallpapering, electrical work, etc.	1	2
b.	Lawn work or yard care, including snow or leaf removal, wood chopping, etc.	1	2
c.	Outdoor gardening	1	2
d.	Caring for an other person, such as children, dependent spouse, or an other adult	1	2

WORK-RELATED ACTIVITY

10. During the past 7 days, did you work for pay or as a volunteer?

[1.] NO [2.] YES

10a. How many hours per week did you work for pay and/or as a volunteer?

_____ HOURS

10b. Which of the following categories best describes the amount of physical activity required on your job and/or volunteer work?

[1] Mainly sitting with slight arm movements. **[Examples:** office worker, watchmaker, seated assembly line worker, bus driver, etc.]

[2] Sitting or standing with some walking. **[Examples:** cashier, general office worker, light tool and machinery worker.]

[3] Walking, with some handling of materials generally weighing less than 50 pounds. **[Examples:** mailman, waiter/waitress, construction worker, heavy tool and machinery worker.]

[4] Walking and heavy manual work often requiring handling of materials weighing over 50 pounds. **[Examples:** lumberjack, stone mason, farm or general laborer.]

THANK YOU FOR TAKING THE TIME AND EFFORT

TO COMPLETE THIS QUESTIONNAIRE!

Appendix G

Raw Subject Data

F-1, M-2

sub#	Group	yrs ex	days/wk	Sex	Age	HT (cm)	Wt (kg)
S3	5	20	4	1	80	170.18	53.181818
S4	5	20	5	2	90	170.18	79.545455
S5	3	4	3	1	65	157.48	75
S6	5	15	5	2	77	182.88	75
S7	5	12	6	2	81	175.26	70.454545
S8	5	20	5	1	87	157.48	53.636364
S9	5	20	5	1	68	167.64	69.545455
S10	4	7	3	2	76	172.72	68.181818
S11	5	10	5	2	83	175.26	67.272727
S12	4	5	4	1	71	162.56	56.818182
S13	5	15	5	2	66	170.18	59.090909
S14	4	6	3	2	80	190.5	109.09091
S15	5	14	3	2	74	185.42	100
S16	5	25	6	1	74	166.37	57.727273
S18	3	2	3	1	70	162.56	56.818182
S19	1	0.25	2	2	74	177.8	90.909091
S20	2	0.9166667	4	2	80	182.88	78.636364
S21	4	6	3	2	70	173.99	68.181818
S22	5	20	4	1	68	132.08	59.090909
S23	2	0.1666667	6	1	66	137.16	80.909091
S24	4	7	4	2	74	185.42	118.18182
S25	4	7	3	2	70	180.34	86.363636
S26	5	15	3	2	81	177.8	72.727273
S27	5	10	4	2	79	187.96	79.545455
S28	2	0.5	3	1	67	162.56	102.27273
S29	1	1	2	2	69	172.72	104.54545
S30	1	4	2	2	89	172.72	68.181818
S31	2	1.5	5	2	69	175.26	70.454545
S32	1	0	0	2	70	170.18	84.090909
S33	1	0	0	2	84	172.72	64.545455
S34	2	0.25	4	1	70	165.1	78.181818
S35	3	2	4	2	77	180.34	81.363636

S36	3	1	3	2	65	170.18	95
S37	3	2	3	2	74	180.34	97.272727
S38	2	0.0833333	3	1	79	165.1	63.636364
S39	2	0.1666667	3	1	76	167.64	65.909091
S40	2	0.0833333	3	2	81	154.94	118.18182
S41	3	2	3	1	81	167.64	70.454545
S42	3	2	5	1	84	162.56	72.727273
S43	3	2	5	2	83	187.96	108.18182
S44	1	0.3333333	2	1	78	157.48	70.454545
S45	1	0	0	2	92	177.8	100
S46	1	0	0	2	69	190.5	106.81818
S47	1	0	0	1	65	162.56	93.181818
S48	3	4	3	1	67	167.64	68.181818
S49	4	6	7	1	90	157.48	55
S51	3	2.5	3	2	73	177.8	90

	1- No HS Grad 2- HS grad 3- Univ 4- grad or proff	1-M, 2-W, 3-D, 4- S	1- Caucasian, 2 Filipino		1- Yes, 2- No
sub#	**Edu**	**Marital**	**Ethnicity**	**Health cond**	**Depression**
S3	4	1	1	2	2
S4	4	1	1	2	2
S5	4	1	1	2	2
S6	4	1	1	1	2
S7	4	1	1	1	2
S8	2	1	1	4	2
S9	3	1	1	0	2
S10	3	1	1	3	2
S11	4	1	1	4	2
S12	3	1	1	1	2
S13	4	1	1	4	2
S14	3	1	1	1	2
S15	3	1	1	4	2
S16	3	1	1	3	2
S18	2	1	1	2	2
S19	4	1	1	3	2
S20	4	3	1	1	2
S21	4	1	1	2	1

S22	3	2	1	2	2
S23	2	1	1	3	2
S24	3	1	1	2	2
S25	4	1	1	2	2
S26	3	1	1	2	2
S27	4	1	1	2	2
S28	2	1	1	5	2
S29	3	1	1	3	2
S30	2	1	1	4	2
S31	3	1	1	1	2
S32	2	4	1	0	2
S33	2	1	1	1	2
S34	3	2	1	3	2
S35	4	1	1	3	1
S36	4	1	1	1	2
S37	3	1	1	0	2
S38	2	1	1	2	2
S39	2	1	1	2	2
S40	1	1	1	4	2
S41	2	1	1	3	2
S42	3	2	1	3	2
S43	2	1	1	3	2
S44	3	1	2	6	2
S45	2	2	1	2	1
S46	4	1	1	1	2
S47	3	1	1	2	2
S48	4	4	1	3	1
S49	1	2	1	2	1
S51	4	1	1	2	1

sub#	CES-D Total	total **PASE**	Sum Pos PANAS	Sum Neg PANAS	Total Score UCLA
S3	0	159.9	39	10	26
S4	0	108.4	37	10	36
S5	18	173.5	34	12	43
S6	2	144.7	38	13	35
S7	0	109.3	41	10	23
S8	10	229.3	34	21	25
S9	6	118.3	38	17	47
S10	1	247.43	44	12	31

S11	4	108.5	30	10	30
S12	0	249.3	42	14	26
S13	9	200.77	42	19	37
S14	3	158.55	32	12	29
S15	2	261.28	38	12	35
S16	7	136.17	38	17	41
S18	7	72.5	35	17	36
S19	6	133.2	41	12	38
S20	9	139.4	26	13	25
S21	4	143.9	38	17	40
S22	2	81.85	36	10	28
S23	1	159.7	39	12	41
S24	3	102.5	25	10	34
S25	10	153.5	29	17	31
S26	1	185	36	14	28
S27	4	34.7	33	12	33
S28	21	102.25	28	23	55
S29	0	62.53	50	10	20
S30	10	73.46	34	12	41
S31	0	136.82	37	10	29
S32	6	12.8	50	18	33
S33	12	31	20	14	31
S34	17	141	46	15	42
S35	9	94.3	27	12	47
S36	1	96.55	35	11	29
S37	5	151.8	30	15	44
S38	0	37.5	25	10	24
S39	1	176.61	44	10	28
S40	6	176	21	10	33
S41	14	209.6	44	11	30
S42	15	154.3	11	14	38
S43	16	43.2	28	12	40
S44	4	233.07	38	18	23
S45	6	0	37	13	33
S46	3	93.44	40	11	30
S47	7	65.64	43	14	28
S48	15	129.2	24	23	43
S49	5	190.85	32	14	35
S51	14	179.9	39	18	26

Appendix H

Results Tables for Statistical Tests

Years Exercising

Tests of Between-Subjects Effects

Dependent Variable:yearsexercising

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2102.405[a]	4	525.601	79.398	.000	.883
Intercept	1247.112	1	1247.112	188.391	.000	.818
Group	2102.405	4	525.601	79.398	.000	.883
Error	278.032	42	6.620			
Total	4203.896	47				
Corrected Total	2380.437	46				

a. R Squared = .883 (Adjusted R Squared = .872)

Estimates

Dependent Variable:yearsexercising

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	.620	.858	-1.110	2.351
less than one year	.458	.910	-1.377	2.294

greater than 1, less than 5 years	2.350	.814	.708	3.992
greater than 5, less than 10	6.286	.972	4.323	8.248
greater than 10 years	16.615	.714	15.175	18.055

Pairwise Comparisons

Dependent Variable:yearsexercising

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	.162	1.250	.897
	greater than 1, less than 5 years	-1.730	1.182	.151
	greater than 5, less than 10	-5.665*	1.297	.000
	greater than 10 years	-15.995*	1.116	.000
less than one year	no exercise	-.162	1.250	.897
	greater than 1, less than 5 years	-1.892	1.220	.129
	greater than 5, less than 10	-5.827*	1.332	.000
	greater than 10 years	-16.157*	1.156	.000
greater than 1, less than	no exercise	1.730	1.182	.151

5 years	less than one year	1.892	1.220	.129
	greater than 5, less than 10	-3.936*	1.268	.003
	greater than 10 years	-14.265*	1.082	.000
greater than 5, less than 10	no exercise	5.665*	1.297	.000
	less than one year	5.827*	1.332	.000
	greater than 1, less than 5 years	3.936*	1.268	.003
	greater than 10 years	-10.330*	1.206	.000
greater than 10 years	no exercise	15.995*	1.116	.000
	less than one year	16.157*	1.156	.000
	greater than 1, less than 5 years	14.265*	1.082	.000
	greater than 5, less than 10	10.330*	1.206	.000

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

Days Per Week

Tests of Between-Subjects Effects

Dependent Variable:daysperweek

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared

Corrected Model	79.291[a]	4	19.823	17.274	.000	.622
Intercept	503.889	1	503.889	439.092	.000	.913
Group	79.291	4	19.823	17.274	.000	.622
Error	48.198	42	1.148			
Total	679.000	47				
Corrected Total	127.489	46				

a. R Squared = .622 (Adjusted R Squared = .586)

Estimates

Dependent Variable:daysperweek

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	.889	.357	.168	1.610
less than one year	3.875	.379	3.111	4.639
greater than 1, less than 5 years	3.500	.339	2.816	4.184
greater than 5, less than 10	3.857	.405	3.040	4.674
greater than 10 years	4.615	.297	4.016	5.215

Pairwise Comparisons

Dependent Variable:daysperweek

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-2.986*	.521	.000
	greater than 1, less than 5 years	-2.611*	.492	.000
	greater than 5, less than 10	-2.968*	.540	.000
	greater than 10 years	-3.726*	.465	.000
less than one year	no exercise	2.986*	.521	.000
	greater than 1, less than 5 years	.375	.508	.465
	greater than 5, less than 10	.018	.554	.974
	greater than 10 years	-.740	.481	.132
greater than 1, less than 5 years	no exercise	2.611*	.492	.000
	less than one year	-.375	.508	.465
	greater than 5, less than 10	-.357	.528	.502
	greater than 10 years	-1.115*	.451	.017
greater than 5, less than 10	no exercise	2.968*	.540	.000
	less than one year	-.018	.554	.974

	greater than 1, less than 5 years	.357	.528	.502
	greater than 10 years	-.758	.502	.139
greater than 10 years	no exercise	3.726*	.465	.000
	less than one year	.740	.481	.132
	greater than 1, less than 5 years	1.115*	.451	.017
	greater than 5, less than 10	.758	.502	.139

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Age

Tests of Between-Subjects Effects

Dependent Variable:age

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	123.565[a]	4	30.891	.532	.713	.048
Intercept	256305.069	1	256305.069	4410.023	.000	.991
Group	123.565	4	30.891	.532	.713	.048
Error	2440.988	42	58.119			
Total	271610.000	47				

Corrected Total	2564.553	46				

a. R Squared = .048 (Adjusted R Squared = -.042)

Estimates

Dependent Variable:age

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	76.667	2.541	71.538	81.795
less than one year	73.500	2.695	68.061	78.939
greater than 1, less than 5 years	73.900	2.411	69.035	78.765
greater than 5, less than 10	75.857	2.881	70.042	81.672
greater than 10 years	77.538	2.114	73.271	81.805

Pairwise Comparisons

Dependent Variable:age

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	3.167	3.704	.397
	greater than 1, less than 5 years	2.767	3.503	.434

	greater than 5, less than 10	.810	3.842	.834
	greater than 10 years	-.872	3.306	.793
less than one year	no exercise	-3.167	3.704	.397
	greater than 1, less than 5 years	-.400	3.616	.912
	greater than 5, less than 10	-2.357	3.946	.553
	greater than 10 years	-4.038	3.426	.245
greater than 1, less than 5 years	no exercise	-2.767	3.503	.434
	less than one year	.400	3.616	.912
	greater than 5, less than 10	-1.957	3.757	.605
	greater than 10 years	-3.638	3.207	.263
greater than 5, less than 10	no exercise	-.810	3.842	.834
	less than one year	2.357	3.946	.553
	greater than 1, less than 5 years	1.957	3.757	.605
	greater than 10 years	-1.681	3.574	.640
greater than 10 years	no exercise	.872	3.306	.793
	less than one year	4.038	3.426	.245
	greater than 1, less than 5 years	3.638	3.207	.263

	greater than 5, less than 10	1.681	3.574	.640

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Height

Tests of Between-Subjects Effects

Dependent Variable:height

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	532.765[a]	4	133.191	.908	.468	.080
Intercept	1310084.384	1	1310084.384	8928.691	.000	.995
Group	532.765	4	133.191	.908	.468	.080
Error	6162.554	42	146.727			
Total	1375664.991	47				
Corrected Total	6695.319	46				

a. R Squared = .080 (Adjusted R Squared = -.008)

Pairwise Comparisons

Dependent Variable:height

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	8.890	5.886	.138

	greater than 1, less than 5 years	1.270	5.566	.821
	greater than 5, less than 10	-1.996	6.104	.745
	greater than 10 years	2.052	5.253	.698
less than one year	no exercise	-8.890	5.886	.138
	greater than 1, less than 5 years	-7.620	5.746	.192
	greater than 5, less than 10	-10.886	6.269	.090
	greater than 10 years	-6.838	5.443	.216
greater than 1, less than 5 years	no exercise	-1.270	5.566	.821
	less than one year	7.620	5.746	.192
	greater than 5, less than 10	-3.266	5.969	.587
	greater than 10 years	.782	5.095	.879
greater than 5, less than 10	no exercise	1.996	6.104	.745
	less than one year	10.886	6.269	.090
	greater than 1, less than 5 years	3.266	5.969	.587
	greater than 10 years	4.047	5.679	.480
greater than 10 years	no exercise	-2.052	5.253	.698
	less than one year	6.838	5.443	.216

	greater than 1, less than 5 years	-.782	5.095	.879
	greater than 5, less than 10	-4.047	5.679	.480

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Weight

Tests of Between-Subjects Effects

Dependent Variable:weight

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2034.527[a]	4	508.632	1.693	.170	.139
Intercept	287809.027	1	287809.027	958.073	.000	.958
Group	2034.527	4	508.632	1.693	.170	.139
Error	12616.967	42	300.404			
Total	308222.727	47				
Corrected Total	14651.495	46				

a. R Squared = .139 (Adjusted R Squared = .057)

Estimates

Dependent Variable:weight

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	86.970	5.777	75.310	98.629
less than one year	82.273	6.128	69.906	94.639
greater than 1, less than 5 years	81.500	5.481	70.439	92.561
greater than 5, less than 10	80.260	6.551	67.039	93.480
greater than 10 years	68.986	4.807	59.285	78.687

Pairwise Comparisons

Dependent Variable:weight

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	4.697	8.422	.580
	greater than 1, less than 5 years	5.470	7.964	.496
	greater than 5, less than 10	6.710	8.735	.447
	greater than 10 years	17.984*	7.516	.021
less than one year	no exercise	-4.697	8.422	.580
	greater than 1, less than 5 years	.773	8.221	.926

	greater than 5, less than 10	2.013	8.970	.824
	greater than 10 years	13.287	7.788	.095
greater than 1, less than 5 years	no exercise	-5.470	7.964	.496
	less than one year	-.773	8.221	.926
	greater than 5, less than 10	1.240	8.541	.885
	greater than 10 years	12.514	7.290	.093
greater than 5, less than 10	no exercise	-6.710	8.735	.447
	less than one year	-2.013	8.970	.824
	greater than 1, less than 5 years	-1.240	8.541	.885
	greater than 10 years	11.274	8.125	.173
greater than 10 years	no exercise	-17.984*	7.516	.021
	less than one year	-13.287	7.788	.095
	greater than 1, less than 5 years	-12.514	7.290	.093
	greater than 5, less than 10	-11.274	8.125	.173

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

Education

Tests of Between-Subjects Effects

Dependent Variable:education

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6.717[a]	4	1.679	2.331	.071	.182
Intercept	394.797	1	394.797	547.942	.000	.929
Group	6.717	4	1.679	2.331	.071	.182
Error	30.261	42	.721			
Total	466.000	47				
Corrected Total	36.979	46				

a. R Squared = .182 (Adjusted R Squared = .104)

Estimates

Dependent Variable:education

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	2.778	.283	2.207	3.349
less than one year	2.375	.300	1.769	2.981
greater than 1, less than 5 years	3.200	.268	2.658	3.742
greater than 5, less than 10	3.000	.321	2.353	3.647

Tests of Between-Subjects Effects

Dependent Variable:education

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6.717[a]	4	1.679	2.331	.071	.182
Intercept	394.797	1	394.797	547.942	.000	.929
Group	6.717	4	1.679	2.331	.071	.182
Error	30.261	42	.721			
Total	466.000	47				
Corrected Total	36.979	46				

a. R Squared = .182 (Adjusted R Squared = .104)

greater than 10 years	3.462	.235	2.986	3.937

Pairwise Comparisons

Dependent Variable:education

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	.403	.412	.334
	greater than 1, less than 5 years	-.422	.390	.285
	greater than 5, less than 10	-.222	.428	.606

	greater than 10 years	-.684	.368	.070
less than one year	no exercise	-.403	.412	.334
	greater than 1, less than 5 years	-.825*	.403	.047
	greater than 5, less than 10	-.625	.439	.162
	greater than 10 years	-1.087*	.381	.007
greater than 1, less than 5 years	no exercise	.422	.390	.285
	less than one year	.825*	.403	.047
	greater than 5, less than 10	.200	.418	.635
	greater than 10 years	-.262	.357	.468
greater than 5, less than 10	no exercise	.222	.428	.606
	less than one year	.625	.439	.162
	greater than 1, less than 5 years	-.200	.418	.635
	greater than 10 years	-.462	.398	.253
greater than 10 years	no exercise	.684	.368	.070
	less than one year	1.087*	.381	.007
	greater than 1, less than 5 years	.262	.357	.468
	greater than 5, less than 10	.462	.398	.253

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

Marital Status

Tests of Between-Subjects Effects

Dependent Variable:maritalstatus

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.127[a]	4	.282	.531	.714	.048
Intercept	74.589	1	74.589	140.625	.000	.770
Group	1.127	4	.282	.531	.714	.048
Error	22.277	42	.530			
Total	100.000	47				
Corrected Total	23.404	46				

a. R Squared = .048 (Adjusted R Squared = -.043)

Tests of Between-Subjects Effects

Dependent Variable:maritalstatus

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.127[a]	4	.282	.531	.714	.048
Intercept	74.589	1	74.589	140.625	.000	.770
Group	1.127	4	.282	.531	.714	.048
Error	22.277	42	.530			
Total	100.000	47				
Corrected Total	23.404	46				

a. R Squared = .048 (Adjusted R Squared = -.043)

Estimates

Dependent Variable:maritalstatus

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	1.444	.243	.955	1.934
less than one year	1.375	.257	.855	1.895
greater than 1, less than 5 years	1.400	.230	.935	1.865
greater than 5, less than 10	1.143	.275	.587	1.698
greater than 10 years	1.077	.202	.669	1.485

Pairwise Comparisons

Dependent Variable:maritalstatus

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	.069	.354	.845
	greater than 1, less than 5 years	.044	.335	.895
	greater than 5, less than 10	.302	.367	.416
	greater than 10 years	.368	.316	.251
less than one year	no exercise	-.069	.354	.845
	greater than 1, less than 5 years	-.025	.345	.943
	greater than 5, less than 10	.232	.377	.541
	greater than 10 years	.298	.327	.368
greater than 1, less than 5 years	no exercise	-.044	.335	.895
	less than one year	.025	.345	.943
	greater than 5, less than 10	.257	.359	.478
	greater than 10 years	.323	.306	.298
greater than 5, less than	no exercise	-.302	.367	.416

10	less than one year	-.232	.377	.541
	greater than 1, less than 5 years	-.257	.359	.478
	greater than 10 years	.066	.341	.848
greater than 10 years	no exercise	-.368	.316	.251
	less than one year	-.298	.327	.368
	greater than 1, less than 5 years	-.323	.306	.298
	greater than 5, less than 10	-.066	.341	.848

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Ethnicity

Tests of Between-Subjects Effects

Dependent Variable:ethnicity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.090[a]	4	.022	1.061	.388	.092
Intercept	46.994	1	46.994	2220.458	.000	.981
Group	.090	4	.022	1.061	.388	.092
Error	.889	42	.021			
Total	50.000	47				

Corrected Total	.979	46				

a. R Squared = .092 (Adjusted R Squared = .005)

Estimates

Dependent Variable:ethnicity

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	1.111	.048	1.013	1.209
less than one year	1.000	.051	.896	1.104
greater than 1, less than 5 years	1.000	.046	.907	1.093
greater than 5, less than 10	1.000	.055	.889	1.111
greater than 10 years	1.000	.040	.919	1.081

Pairwise Comparisons

Dependent Variable:ethnicity

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	.111	.071	.123
	greater than 1, less than 5 years	.111	.067	.104

	greater than 5, less than 10	.111	.073	.137
	greater than 10 years	.111	.063	.085
less than one year	no exercise	-.111	.071	.123
	greater than 1, less than 5 years	3.611E-17	.069	1.000
	greater than 5, less than 10	-2.419E-17	.075	1.000
	greater than 10 years	6.686E-17	.065	1.000
greater than 1, less than 5 years	no exercise	-.111	.067	.104
	less than one year	-3.611E-17	.069	1.000
	greater than 5, less than 10	-6.030E-17	.072	1.000
	greater than 10 years	3.074E-17	.061	1.000
greater than 5, less than 10	no exercise	-.111	.073	.137
	less than one year	2.419E-17	.075	1.000
	greater than 1, less than 5 years	6.030E-17	.072	1.000
	greater than 10 years	9.105E-17	.068	1.000
greater than 10 years	no exercise	-.111	.063	.085
	less than one year	-6.686E-17	.065	1.000
	greater than 1, less than 5 years	-3.074E-17	.061	1.000

	greater than 5, less than 10	-9.105E-17	.068	1.000

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Health Conditions

Tests of Between-Subjects Effects

Dependent Variable:healthconditions

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2.581[a]	4	.645	.368	.830	.034
Intercept	238.370	1	238.370	135.969	.000	.764
Group	2.581	4	.645	.368	.830	.034
Error	73.631	42	1.753			
Total	329.000	47				
Corrected Total	76.213	46				

a. R Squared = .034 (Adjusted R Squared = -.058)

Tests of Between-Subjects Effects

Dependent Variable:healthconditions

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2.581[a]	4	.645	.368	.830	.034
Intercept	238.370	1	238.370	135.969	.000	.764
Group	2.581	4	.645	.368	.830	.034
Error	73.631	42	1.753			
Total	329.000	47				
Corrected Total	76.213	46				

a. R Squared = .034 (Adjusted R Squared = -.058)

Estimates

Dependent Variable:healthconditions

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	2.444	.441	1.554	3.335
less than one year	2.625	.468	1.680	3.570
greater than 1, less than 5 years	2.200	.419	1.355	3.045
greater than 5, less than 10	1.857	.500	.847	2.867
greater than 10 years	2.385	.367	1.644	3.126

Pairwise Comparisons

Dependent Variable:healthconditions

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-.181	.643	.780
	greater than 1, less than 5 years	.244	.608	.690
	greater than 5, less than 10	.587	.667	.384
	greater than 10 years	.060	.574	.918
less than one year	no exercise	.181	.643	.780
	greater than 1, less than 5 years	.425	.628	.502
	greater than 5, less than 10	.768	.685	.269
	greater than 10 years	.240	.595	.688
greater than 1, less than 5 years	no exercise	-.244	.608	.690
	less than one year	-.425	.628	.502
	greater than 5, less than 10	.343	.653	.602
	greater than 10 years	-.185	.557	.742
greater than 5, less than	no exercise	-.587	.667	.384

10	less than one year	-.768	.685	.269
	greater than 1, less than 5 years	-.343	.653	.602
	greater than 10 years	-.527	.621	.400
greater than 10 years	no exercise	-.060	.574	.918
	less than one year	-.240	.595	.688
	greater than 1, less than 5 years	.185	.557	.742
	greater than 5, less than 10	.527	.621	.400

Based on estimated marginal means

Depression

Tests of Between-Subjects Effects

Dependent Variable:depression

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.817[a]	4	.204	1.941	.121	.156
Intercept	155.694	1	155.694	1480.298	.000	.972
Group	.817	4	.204	1.941	.121	.156
Error	4.417	42	.105			
Total	170.000	47				

Corrected Total	5.234	46				

a. R Squared = .156 (Adjusted R Squared = .076)

Estimates

Dependent Variable:depression

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	1.889	.108	1.671	2.107
less than one year	2.000	.115	1.769	2.231
greater than 1, less than 5 years	1.700	.103	1.493	1.907
greater than 5, less than 10	1.714	.123	1.467	1.962
greater than 10 years	2.000	.090	1.818	2.182

Pairwise Comparisons

Dependent Variable:depression

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-.111	.158	.485
	greater than 1, less than 5 years	.189	.149	.212
	greater than 5, less than 10	.175	.163	.291

	greater than 10 years	-.111	.141	.434
less than one year	no exercise	.111	.158	.485
	greater than 1, less than 5 years	.300	.154	.058
	greater than 5, less than 10	.286	.168	.096
	greater than 10 years	1.204E-16	.146	1.000
greater than 1, less than 5 years	no exercise	-.189	.149	.212
	less than one year	-.300	.154	.058
	greater than 5, less than 10	-.014	.160	.929
	greater than 10 years	-.300*	.136	.033
greater than 5, less than 10	no exercise	-.175	.163	.291
	less than one year	-.286	.168	.096
	greater than 1, less than 5 years	.014	.160	.929
	greater than 10 years	-.286	.152	.067
greater than 10 years	no exercise	.111	.141	.434
	less than one year	-1.204E-16	.146	1.000
	greater than 1, less than 5 years	.300*	.136	.033
	greater than 5, less than 10	.286	.152	.067

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

CES-D

Tests of Between-Subjects Effects

Dependent Variable:CESD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	404.049[a]	4	101.012	4.018	.008	.277
Intercept	1796.853	1	1796.853	71.481	.000	.630
Group	404.049	4	101.012	4.018	.008	.277
Error	1055.780	42	25.138			
Total	3324.000	47				
Corrected Total	1459.830	46				

a. R Squared = .277 (Adjusted R Squared = .208)

Estimates

Dependent Variable:CESD

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound

no exercise	6.000	1.671	2.627	9.373
less than one year	6.875	1.773	3.298	10.452
greater than 1, less than 5 years	11.400	1.585	8.200	14.600
greater than 5, less than 10	3.714	1.895	-.110	7.539
greater than 10 years	3.615	1.391	.809	6.422

Pairwise Comparisons

Dependent Variable:CESD

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-.875	2.436	.721
	greater than 1, less than 5 years	-5.400*	2.304	.024
	greater than 5, less than 10	2.286	2.527	.371
	greater than 10 years	2.385	2.174	.279
less than one year	no exercise	.875	2.436	.721
	greater than 1, less than 5 years	-4.525	2.378	.064
	greater than 5, less than 10	3.161	2.595	.230

	greater than 10 years	3.260	2.253	.155
greater than 1, less than 5 years	no exercise	5.400*	2.304	.024
	less than one year	4.525	2.378	.064
	greater than 5, less than 10	7.686*	2.471	.003
	greater than 10 years	7.785*	2.109	.001
greater than 5, less than 10	no exercise	-2.286	2.527	.371
	less than one year	-3.161	2.595	.230
	greater than 1, less than 5 years	-7.686*	2.471	.003
	greater than 10 years	.099	2.350	.967
greater than 10 years	no exercise	-2.385	2.174	.279
	less than one year	-3.260	2.253	.155
	greater than 1, less than 5 years	-7.785*	2.109	.001
	greater than 5, less than 10	-.099	2.350	.967

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

PASE

Tests of Between-Subjects Effects

Dependent Variable:PASE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	42788.735[a]	4	10697.184	3.113	.025	.229
Intercept	795459.088	1	795459.088	231.513	.000	.846
Group	42788.735	4	10697.184	3.113	.025	.229
Error	144308.162	42	3435.909			
Total	1005884.982	47				
Corrected Total	187096.897	46				

a. R Squared = .229 (Adjusted R Squared = .155)

Estimates

Dependent Variable:PASE

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	78.349	19.539	38.918	117.780
less than one year	133.660	20.724	91.837	175.483
greater than 1, less than 5 years	130.485	18.536	93.077	167.893
greater than 5, less than 10	178.004	22.155	133.294	222.715
greater than 10 years	144.475	16.257	111.666	177.283

Pairwise Comparisons

Dependent Variable:PASE

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-55.311	28.483	.059
	greater than 1, less than 5 years	-52.136	26.932	.060
	greater than 5, less than 10	-99.655*	29.540	.002
	greater than 10 years	-66.126*	25.418	.013
less than one year	no exercise	55.311	28.483	.059
	greater than 1, less than 5 years	3.175	27.804	.910
	greater than 5, less than 10	-44.344	30.337	.151
	greater than 10 years	-10.815	26.340	.683
greater than 1, less than 5 years	no exercise	52.136	26.932	.060
	less than one year	-3.175	27.804	.910
	greater than 5, less than 10	-47.519	28.887	.107
	greater than 10 years	-13.990	24.655	.573
greater than 5, less than 10	no exercise	99.655*	29.540	.002
	less than one year	44.344	30.337	.151

	greater than 1, less than 5 years	47.519	28.887	.107
	greater than 10 years	33.530	27.480	.229
greater than 10 years	no exercise	66.126*	25.418	.013
	less than one year	10.815	26.340	.683
	greater than 1, less than 5 years	13.990	24.655	.573
	greater than 5, less than 10	-33.530	27.480	.229

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

PANAS Positive

Descriptive Statistics

Dependent Variable:PANASpos

Group	Mean	Std. Deviation	N
no exercise	39.22	9.038	9
less than one year	33.25	9.438	8
greater than 1, less than 5 years	30.70	9.117	10
greater than 5, less than 10	34.57	6.973	7

greater than 10 years	36.92	3.226	13
Total	35.06	7.886	47

Tests of Between-Subjects Effects

Dependent Variable:PANASpos

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	419.016[a]	4	104.754	1.802	.146	.146
Intercept	54882.068	1	54882.068	943.998	.000	.957
Group	419.016	4	104.754	1.802	.146	.146
Error	2441.793	42	58.138			
Total	60646.000	47				
Corrected Total	2860.809	46				

a. R Squared = .146 (Adjusted R Squared = .065)

Pairwise Comparisons

Dependent Variable:PANASpos

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	5.972	3.705	.114
	greater than 1, less than 5 years	8.522*	3.503	.019

	greater than 5, less than 10	4.651	3.843	.233
	greater than 10 years	2.299	3.306	.491
less than one year	no exercise	-5.972	3.705	.114
	greater than 1, less than 5 years	2.550	3.617	.485
	greater than 5, less than 10	-1.321	3.946	.739
	greater than 10 years	-3.673	3.426	.290
greater than 1, less than 5 years	no exercise	-8.522*	3.503	.019
	less than one year	-2.550	3.617	.485
	greater than 5, less than 10	-3.871	3.758	.309
	greater than 10 years	-6.223	3.207	.059
greater than 5, less than 10	no exercise	-4.651	3.843	.233
	less than one year	1.321	3.946	.739
	greater than 1, less than 5 years	3.871	3.758	.309
	greater than 10 years	-2.352	3.575	.514
greater than 10 years	no exercise	-2.299	3.306	.491
	less than one year	3.673	3.426	.290
	greater than 1, less than 5 years	6.223	3.207	.059

	greater than 5, less than 10	2.352	3.575	.514

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

PANAS Negative

Tests of Between-Subjects Effects

Dependent Variable:PANASneg

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12.595[a]	4	3.149	.237	.916	.022
Intercept	8344.219	1	8344.219	627.771	.000	.937
Group	12.595	4	3.149	.237	.916	.022
Error	558.257	42	13.292			
Total	9313.000	47				
Corrected Total	570.851	46				

a. R Squared = .022 (Adjusted R Squared = -.071)

Tests of Between-Subjects Effects

Dependent Variable:PANASneg

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12.595[a]	4	3.149	.237	.916	.022
Intercept	8344.219	1	8344.219	627.771	.000	.937
Group	12.595	4	3.149	.237	.916	.022
Error	558.257	42	13.292			
Total	9313.000	47				
Corrected Total	570.851	46				

a. R Squared = .022 (Adjusted R Squared = -.071)

Estimates

Dependent Variable:PANASneg

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	13.556	1.215	11.103	16.008
less than one year	12.875	1.289	10.274	15.476
greater than 1, less than 5 years	14.500	1.153	12.173	16.827
greater than 5, less than 10	13.714	1.378	10.933	16.495
greater than 10 years	13.462	1.011	11.421	15.502

Pairwise Comparisons

Dependent Variable:PANASneg

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	.681	1.772	.703
	greater than 1, less than 5 years	-.944	1.675	.576
	greater than 5, less than 10	-.159	1.837	.932
	greater than 10 years	.094	1.581	.953
less than one year	no exercise	-.681	1.772	.703
	greater than 1, less than 5 years	-1.625	1.729	.353
	greater than 5, less than 10	-.839	1.887	.659
	greater than 10 years	-.587	1.638	.722
greater than 1, less than 5 years	no exercise	.944	1.675	.576
	less than one year	1.625	1.729	.353
	greater than 5, less than 10	.786	1.797	.664
	greater than 10 years	1.038	1.534	.502
greater than 5, less than 10	no exercise	.159	1.837	.932
	less than one year	.839	1.887	.659

	greater than 1, less than 5 years	-.786	1.797	.664
	greater than 10 years	.253	1.709	.883
greater than 10 years	no exercise	-.094	1.581	.953
	less than one year	.587	1.638	.722
	greater than 1, less than 5 years	-1.038	1.534	.502
	greater than 5, less than 10	-.253	1.709	.883

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

UCLA Loneliness Scale

Tests of Between-Subjects Effects

Dependent Variable:UCLA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	264.770[a]	4	66.193	1.212	.320	.103
Intercept	50714.430	1	50714.430	928.376	.000	.957
Group	264.770	4	66.193	1.212	.320	.103
Error	2294.336	42	54.627			
Total	55674.000	47				
Corrected Total	2559.106	46				

a. R Squared = .103 (Adjusted R Squared = .018)

Estimates

Dependent Variable:UCLA

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
no exercise	30.778	2.464	25.806	35.750
less than one year	34.625	2.613	29.352	39.898
greater than 1, less than 5 years	37.600	2.337	32.883	42.317
greater than 5, less than 10	32.286	2.794	26.648	37.923
greater than 10 years	32.615	2.050	28.479	36.752

Pairwise Comparisons

Dependent Variable:UCLA

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
no exercise	less than one year	-3.847	3.591	.290
	greater than 1, less than 5 years	-6.822	3.396	.051
	greater than 5, less than 10	-1.508	3.725	.688
	greater than 10 years	-1.838	3.205	.569

less than one year	no exercise	3.847	3.591	.290
	greater than 1, less than 5 years	-2.975	3.506	.401
	greater than 5, less than 10	2.339	3.825	.544
	greater than 10 years	2.010	3.321	.548
greater than 1, less than 5 years	no exercise	6.822	3.396	.051
	less than one year	2.975	3.506	.401
	greater than 5, less than 10	5.314	3.642	.152
	greater than 10 years	4.985	3.109	.116
greater than 5, less than 10	no exercise	1.508	3.725	.688
	less than one year	-2.339	3.825	.544
	greater than 1, less than 5 years	-5.314	3.642	.152
	greater than 10 years	-.330	3.465	.925
greater than 10 years	no exercise	1.838	3.205	.569
	less than one year	-2.010	3.321	.548
	greater than 1, less than 5 years	-4.985	3.109	.116
	greater than 5, less than 10	.330	3.465	.925

Based on estimated marginal means

Tests of Between-Subjects Effects

Dependent Variable:UCLA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	264.770[a]	4	66.193	1.212	.320	.103
Intercept	50714.430	1	50714.430	928.376	.000	.957
Group	264.770	4	66.193	1.212	.320	.103
Error	2294.336	42	54.627			
Total	55674.000	47				
Corrected Total	2559.106	46				

a. R Squared = .103 (Adjusted R Squared = .018)

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).